PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

(*Institution Deemed to be University*)

U/S 3 of UGC Act, 1956

Thanjavur – 613 403, Tamil Nadu

SCHOOL OF ENGINEERING AND TECHNOLOGY

ELECTRONICS AND COMMUNICATION ENGINEERING

B-TECH

FULL TIME

(2021 REGULATION)

SYLLABUS

PRIST
DEEMED TO BE
UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMIL NADU

SCHOOLOFENGINEERINGANDTECHNOLOGY

DEPARTMENTOF

ELECTRONICS&COMMUNICATIONENGINEERING

PROGRAMHANDBOOK

B.TECH–FULLTIME

[REGULATION2021]

B.TECH(FULLTIME)–ECE–R-2021

PROGRAMEDUCATIONALOBJECTIVES (PEOs)

PEO1: To provide the students with a strong foundation in the required sciences in order to pursue studies in Electronics and Communication Engineering.

PEO2: To gain adequate knowledge to become good professional in electronic and communication engineering associated industries, higher education and research.

PEO3: To develop attitude in lifelong learning, applying and adapting new ideas and technologies as their field evolves.

PEO4: To prepare students to critically analyze existingliterature in an area of specialization and ethically develop innovative and research oriented methodologies to solve the problems identified.

PEO5: To inculcate in the students a professional and ethical attitude and an ability to visualize the engineering issues in a broader social context.

PROGRAM OUTCOMES(POs)

PO1: **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3:**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilitiesrelevant to the professional engineering practice.

PO7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8:**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: **Project management and finance:** Demonstrate knowledge and understanding of the engineeringand managementprinciples andapplytheseto one'sownwork, asamember and leader in a team, to manage projects and in multidisciplinaryenvironments.

PO12: **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMSPECIFICOUTCOMES(PSOs)

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

PSO2: Design, develop and analyze communication systems through applicationof fundamentals from communication principles, signal processing, and RF System Design & Electromagnetics.

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

B.TECH(FULLTIME)–ECE–R-2021 I -

VIII SEMESTERS CURRICULUM

SEMESTER I

Sl. No.	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	21147IP	InductionProgramme	-	-	-	0
2.	21147S11	ProfessionalEnglish- I	3	0	0	3
3.	21148S12	MatricesandCalculus	3	1	0	4
4.	21149S13	EngineeringPhysics	3	0	0	3
5.	21149S14	EngineeringChemistry	3	0	0	3
6.	21150S15	Problem Solving and Python Programming	3	0	0	3
PRACTICALS						
7.	21150L16	Problem Solving and Python Programming Laboratory	0	0	4	2
8.	21149L17	PhysicsandChemistryLaboratory	0	0	4	2
9.	21147L18	CommunicationLab–I	0	0	2	1
		TOTAL	15	1	10	**21**

SEMESTERII

Sl. No.	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	21147S21	Professional English – II (COMMON TO CIVIL, CSE, EEE,ECE,MECH)	3	0	0	3
2.	21148S22	StatisticsandNumericalMethods (COMMONTOCIVIL,CSE,EEE, ECE, MECH)	3	1	0	4
3.	21149S23B	PhysicsforElectronicsEngineering	3	0	0	3
4.	21154S24	EngineeringGraphics(COMMONTO CIVIL, CSE, EEE,ECE,MECH)	2	0	4	4
5.	21153S25B	Electrical and Instrumentation Engineering	3	0	0	3
6.	21153S26A	CircuitAnalysis	3	1	0	4
PRACTICALS						
7.	21154L27	EngineeringPractices Laboratory(COMMONTOALL)	0	0	4	2
8.	21153L28A	CircuitsAnalysisLaboratory	0	0	4	2
9.	21147L29	CommunicationLab–II	0	0	4	2
		TOTAL	17	2	16	**27**

SEMESTERIII

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	21148S31B	RandomProcessesandLinearAlgebra	3	1	0	4
2.	21152S32	ControlSystems	3	0	0	3
3.	21152S33	CProgrammingandDataStructures	3	0	0	3
4.	21152C34	*DigitalSystemsDesign*	3	0	2	4
5.	21152C35	SignalsandSystems	3	1	0	4
6.	21152C36	ElectronicDevicesandCircuits	3	0	0	3
PRACTICALS						
7.	21152L37	CProgrammingandDataStructures Lab	0	0	4	2
8.	21152L38	ElectronicDevicesandCircuitsLab	0	0	4	2
9.	21152L39	ProfessionalDevelopment	0	0	2	1
		TOTAL	18	2	12	**26**

SEMESTERIV

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	21152C41	ElectromagneticFields	3	0	0	3
2.	21152C42	LinearIntegratedCircuits	3	0	0	3
3.	21152C43	CommunicationSystems	3	0	0	3
4.	21152C44	*DigitalSignalProcessing*	3	0	2	4
5.	21152C45	*NetworksandSecurity*	3	0	2	4
6.	21149S46	EnvironmentalSciencesand Sustainability	2	0	0	2
PRACTICALS						
7.	21152L47	LinearIntegratedCircuits Laboratory	0	0	4	2
8.	21152L48	CommunicationSystems Laboratory	0	0	4	2
		TOTAL	17	0	12	**23**

SEMESTERV

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	21152C51	*WirelessCommunication*	3	0	2	4
2.	21152C52	VLSIandChip Design	3	0	0	3
3.	21152C53	TransmissionLinesandRFSystems	3	0	0	3
4.	**21152E54_**	**Elective- I**	3	0	0	3
5.	**21152E55_**	**Elective–II**	3	0	0	3
6.	**21152E56_**	**Elective- III**	3	0	0	3
7.	**21147MC51_**	**MandatoryCourse-I**	3	0	0	0
PRACTICALS						
8.	20152L58	VLSILaboratory	0	0	4	2
		TOTAL	21	0	4	**21**

SEMESTERVI

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	21152S61	*EmbeddedSystemsandIOT Design*	3	0	2	4
2.	21152S62	*ArtificialIntelligenceandMachine Learning*	3	0	2	4
3.	**211 OE63_**	**OpenElective-I**	3	0	0	3
4.	**21152E64_**	**Elective–IV**	3	0	0	3
5.	**21152E65_**	**Elective–V**	3	0	0	3
6.	**21152E66_**	**Elective–VI**	3	0	0	3
7.	**21147MC61_**	**MandatoryCourse-II**	3	0	0	0
		TOTAL	21	0	4	**20**

SEMESTERVII

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
THEORY						
1.	211_ S71	HumanValuesandEthics	2	0	0	2
2.	**21160S72_**	**Elective-VII**	3	0	0	3
3.	**211__OE73_**	**OpenElective– II**	3	0	0	3
4.	**211__OE74_**	**OpenElective– III**	3	0	0	3
5.	**211__OE75_**	**OpenElective–IV**	3	0	0	3
PRACTICALS						
6.	21152INT76	SummerInternship	0	0	0	2
		TOTAL	14	0	0	**16**

SEMESTERVIII

Sl.No	COURSE CODE	COURSETITLE	L	T	P	C
PRACTICALS						
1.	21152P81	ProjectWork	0	0	20	10
		TOTAL	0	0	20	**10**
		TOTALNO.OFCREDITS:				**164**

LISTOFELECTIVES

ELECTIVE-I(SEMESTERV)

Sl. No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21152E54A	OpticalCommunication Networks	3	0	0	3
2.	21152E54B	4G/5GCommunication Networks	3	0	0	3
3.	21152E54C	AvionicsSystems	3	0	0	3

ELECTIVE–II(SEMESTERV)

Sl. No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21152E55A	SoftwareDefinedNetworks	3	0	0	3
2.	21152E55B	ImageProcessing	3	0	0	3
3.	21152E55C	SpeechProcessing	3	0	0	3

ELECTIVE–III(SEMESTERV)

Sl. No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21152E56A	DSPArchitectureand Programming	3	0	0	3
2.	21152E56B	WirelessSensorNetwork Design	3	0	0	3
3.	21152E56C	ComputerVision	3	0	0	3

ELECTIVE–IV(SEMESTERVI)

Sl. No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21152E64A	SoftwareDefinedRadio	3	0	0	3
2.	21152E64B	SatelliteCommunication	3	0	0	3
3.	21152E64C	MassiveMIMONetworks	3	0	0	3

ELECTIVE-V(SEMESTERVI)

Sl. No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21152E65A	Advanced Wireless CommunicationTechniques	3	0	0	3
2.	21152E65B	WearableDevices	3	0	0	3
3.	21152E65C	Fundamentalsof Nanoelectronics	3	0	0	3

ELECTIVE-VI(SEMESTER VI)

Sl. No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21152E66A	RemoteSensing	3	0	0	3
2.	21152E66B	HumanAssistDevices	3	0	0	3
3.	21152E66C	MEMSDesign	3	0	0	3

ELECTIVE-VII(SEMESTERVII)

Sl. No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21160S72A	PrinciplesofManagement	3	0	0	3
2.	21160S72B	TotalQualityManagement	3	0	0	3
3.	21160S72C	HumanResource Management	3	0	0	3

LISTOFOPENELECTIVES

OPENELECTIVE–I(SEMESTERVI)

Sl. No	DEPT	COURSE CODE	COURSETITLE	L	T	P	C
1.	Civil	21155OE63	ClimateChangeandits Impact	3	0	0	3
2.	EEE	21153OE63	RenewableEnergySystem	3	0	0	3
3.	Mech	21154OE63	IntroductiontoIndustrial Engineering	3	0	0	3
4.	CSE	21150OE63	GraphTheory	3	0	0	3
5.	ECE **	21152OE63	Deep Learning	3	0	0	3

**Applicableforother Departments

OPENELECTIVE–II(SEMESTER VII)

Sl. No	DEPT	COURSE CODE	COURSETITLE	L	T	P	C
1.	Civil	21155OE73	ICT inAgriculture	3	0	0	3
2.	EEE	21153OE73	IntroductiontoControl Engineering	3	0	0	3
3.	Mech	21154OE73	AviationManagement	3	0	0	3

4.	CSE	21150OE73	Dev-Ops	3	0	0	3
5.	ECE **	21152OE73	RoboticsProcessAutomation	3	0	0	3

**ApplicableforotherDepartments

OPENELECTIVE–III(SEMESTER VII)

Sl. No	DEPT	COURSE CODE	COURSETITLE	L	T	P	C
1.	Eng	21147OE74	EnglishforCompetitive Examinations	3	0	0	3
2.	Civil	21155OE74A	RemoteSensingConcepts	3	0	0	3
3.	Civil	21155OE74B	DrinkingWaterSupplyand Treatment	3	0	0	3
4.	EEE	21153OE74A	RenewableEnergy Technologies	3	0	0	3
5.	EEE	21153OE74B	ElectricandHybridVehicle	3	0	0	3
6.	Mech	21154OE74A	IndustrialManagement	3	0	0	3
7.	Mech	21154OE74B	IntroductiontoNonDestructive Testing	3	0	0	3
8.	ECE **	21152OE74A	BiomedicalInstrumentation	3	0	0	3
9.	ECE **	21152OE74B	FundamentalsofElectronic Devices and Circuits	3	0	0	3

**Applicableforother Departments

OPENELECTIVE–IV(SEMESTERVII)

Sl. No	DEPT	COURSE CODE	COURSETITLE	L	T	P	C
1.	Civil	21155OE75A	Geographical Information System	3	0	0	3
2.	Civil	21155OE75B	BasicsofIntegratedWater Resources Management	3	0	0	3
3.	EEE	21153OE75A	Sensors	3	0	0	3
4.	EEE	21153OE75B	Electrical,Electronicand Magnetic materials	3	0	0	3

5.	Mech	21154OE75A	AdditiveManufacturing	3	0	0	3
6.	Mech	21154OE75B	IndustrialSafety	3	0	0	3
7.	ECE **	21152OE75A	WearableDevices	3	0	0	3
8.	ECE **	21152OE75B	MedicalInformatics	3	0	0	3

**Applicableforother Departments

LISTOFMANDATORYCOURSES

MANDATORYCOURSE–I(SEMESTERV)

Sl. No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21147MC51A	IntroductiontoWomenand Gender Studies	3	0	0	3
2.	21147MC51B	DisasterManagement	3	0	0	3
3.	21147MC51C	FilmAppreciation	3	0	0	3
4.	21147MC51D	ElementsofLiterature	3	0	0	3

MANDATORYCOURSE–II(SEMESTER VI)

Sl. No	COURSE CODE	COURSETITLE	L	T	P	C
1.	21147MC61A	WellBeingwithTraditional Practices(Yoga,Ayurvedaand Siddha)	3	0	0	3
2.	21147MC61B	HistoryofScienceand Technology in India	3	0	0	3
3.	21147MC61C	PoliticalandEconomicThought for a Humane Society	3	0	0	3
4.	21147MC61D	State,NationBuildingand Politics in India	3	0	0	3
5.	21147MC61E	SafetyinEngineeringindustry	3	0	0	3

B.TECH(FULLTIME)–ECE–R-2021

CREDITSDISTRIBUTION
CGPA CREDITS

Sem.	CoreCourses				Elective Courses				Foundation Courses		Mandatory Courses		TOTAL CGPACredits
	Theory Courses		Practical Courses		Dept.Elective		OpenElective						
	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	01	3	03	5	-	-	-	-	04	13	-	-	21
II	02	7	03	6	-	-	-	-	04	14	-	-	27
III	05	17	03	5	-	-	-	-	01	4	-	-	26
IV	05	17	02	4	-	-	-	-	01	2	-	-	23
V	03	10	01	2	03	9	-	-	-	-	1	0	21
VI	02	8	-	-	03	9	01	3	-	-	1	0	20
VII	-	-	01	2	01	3	03	9	01	2	-	-	16
VIII	-	-	01	10	-	-	-	-	-	-	-	-	10
TOTALCREDITS													**164**

NONCGPACREDITS

Sem.	Non-CGPACredits	
	NoofCourses	Credits
I	01	00
II	-	-
III	-	-
IV	-	-
V	01	00
VI	01	00
VII	-	-
VIII	-	-
Total	**03**	**00**

21147IP **INDUCTIONPROGRAMME**

Thisisamandatory 2weekprogrammetobeconductedassoonasthestudentsenterthe institution. Normal classes start only after the induction program is over.

TheinductionprogrammehasbeenintroducedbyAICTEwiththefollowingobjective:

"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 a broad understanding of society and relationships. Character needs to be nurturedas an essential qualitybywhich 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 wellas between faculty and students, develop awareness, sensitivity and understanding of the self, peoplearound 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) PhysicalActivity

Thiswouldinvolveadailyroutineofphysicalactivitywithgamesandsports,yoga,gardening,etc.

(ii) CreativeArts

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 pursueit everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and
alsoenhancecreativitywhichwould,hopefully,growintoengineeringdesignlater.

(iii) UniversalHumanValues

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, make 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 don'ts, but get students to explore and think by engaging them in a dialogue.Itisbesttaughtthroughgroupdiscussionsandreallifeactivitiesratherthan

lecturing.
Discussionswouldbeconductedinsmallgroupsofabout20studentswithafaculty mentoreach.Itwouldbeeffectivethatthefacultymentorassignedisalsothefaculty advisor for the student for the full duration of the UG programme.

(iv) LiteraryActivity

Literaryactivitywouldencompassreading,writingandpossibly,debating,enactingaplayetc.

(v) ProficiencyModules

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

(vi) LecturesbyEminentPeople

Motivational lecturesby eminent people from all walks oflife shouldbe arranged togive the students exposure to people who are socially active or in public life.

(vii) VisitstoLocalArea

Acouple of visits to the landmarks of the city, or a hospital or orphanage could be organized. Thiswould familiarize them with the area as well as expose them to the underprivileged.

(viii) FamiliarizationtoDept./Branch&Innovations

Theyshould be told about what getting into a branch or department means what role it plays insociety,throughitstechnology.Theyshouldalsobeshownthe laboratories,workshops& other facilities.

(ix) DepartmentSpecificActivities

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 aworkshop.Forexample,CSEand ITstudentsmaybe introduced toactivitiesthatkindle computational thinking, and get them to build simple games. ECE students may be introducedto building simple circuits asan extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programmeistotallyanactivitybased programmeandthereforethereshallbenotests/ assessments during this programme.

References:
GuidetoInductionprogramfromAICTE

21147S11 PROFESSIONALENGLISH-I LTPC31 04

COURSEOBJECTIVES:

- Toimprovethecommunicativecompetenceoflearners
- Tohelplearnersuselanguageeffectivelyinacademic/workcontexts
- Tobuildonstudents'Englishlanguageskills byengaging theminlistening,speakingand grammar learning activities that are relevant to authentic contexts.
- To develop learners' abilityto read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.
- Touselanguageefficientlyinexpressingtheiropinions viavarious media.

INTRODUCTIONTOEFFECTIVECOMMUNICATION 1

- Whatiseffectivecommunication?(Therearemanyinterestingactivitiesforthis.)
- Whyiscommunicationcriticalforexcellenceduringstudy,researchand work?
- WhatarethesevenC'sofeffectivecommunication?
- Whatarekeylanguageskills?
- Whatiseffectivelistening?Whatdoesit involve?
- Whatiseffectivespeaking?
- Whatdoesitmeantobeanexcellentreader?Whatshouldyoubeabletodo?
- Whatiseffectivewriting?
- Howdoesonedeveloplanguageand communicationskills?
- What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

UNITI INTRODUCTIONTOFUNDAMENTALSOFCOMMUNICATION 11

Listening –for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form

Speaking - Self Introduction; Introducing a friend; Conversation - politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form.

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails.

Writing-Writingemails/lettersintroducingoneself

Grammar - Present Tense (simple and progressive); Question types: Wh / Yes or No/ and Tags

Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technicalcontexts).

UNITII NARRATIONANDSUMMATION 12

Listening-Listeningtopodcasts,anecdotes/stories/eventnarration;documentariesand interviews with celebrities.

Speaking- Narratingpersonal experiences/ events;Interviewingacelebrity; Reporting/ andsummarizing documentaries / podcasts/ interviews.

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, andtravel & technical blogs.

Writing-Guidedwriting--ParagraphwritingShortReportonanevent(fieldtripetc.)Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions
Vocabulary-Wordforms(prefixes&suffixes);SynonymsandAntonyms.Phrasalverbs.

UNITIII DESCRIPTIONOFAPROCESS/PRODUCT 12

Listening - Listen to a product and process descriptions; a classroom lecture; and advertisementsabout products.
Speaking – Picture description; giving instruction to use the product; Presenting a product; andSummarizing a lecture.
Reading – Reading advertisements, gadget reviews; user manuals. Writing -Writing definitions; instructions; and Product /Process description.
Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses.
Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives &sequence words)

UNITIV CLASSIFICATIONANDRECOMMENDATIONS 12

eports–andNonVerbalCommunication(tables,piechartsetc,)
Writing – Note-making / Note-taking (*Study skills to be taught, not tested; Writing recommendations; Transferring information fromnon verbal (chart , graph etc, to verbal mode)
Grammar – Articles; Pronouns - Possessive & Relative pronouns.
Vocabulary-Collocations;Fixed/Semifixedexpressions.

UNITV EXPRESSION 12

Listening–Listeningtodebates/discussions;differentviewpointsonanissue;andpanel discussions.
Speaking –group discussions, Debates, and Expressing opinions through Simulations &Roleplay.Reading – Reading editorials; and Opinion Blogs;
Writing–EssayWriting(Descriptiveornarrative).
Grammar–FutureTenses,Punctuation;Negation(Statements &Questions);andSimple, Compound & Complex Sentences.
Vocabulary-Cause&EffectExpressions–ContentvsFunction words.

TOTAL:60PERIODS

COURSEOUTCOMES:

Attheendofthecourse,learnerswillbeable

- Tolistenandcomprehendcomplexacademictexts
- Toreadandinferthedenotative andconnotativemeaningsoftechnicaltexts
- Towritedefinitions, descriptions,narrationsandessaysonvarioustopics
- Tospeakfluentlyandaccuratelyinformalandinformalcommunicative contexts
- Toexpresstheiropinions effectivelyinbothoralandwrittenmediumofcommunication

TEXTBOOKS:

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department ofEnglish, Anna University, (2020 edition).
2. EnglishforScience&TechnologyCambridgeUniversityPress,2021.
3. AuthoredbyDr.VeenaSelvam,Dr. SujathaPriyadarshini, Dr.DeepaMaryFrancis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:

1. Technical Communication – Principles and Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. ACourseBookonTechnicalEnglishByLakshmiNarayanan,ScitechPublications(India) Pvt. Ltd.
3. English For Technical Communication (With CD) ByAysha Viswamohan, Mcgraw Hill Education, ISBN : 0070264244.
4. EffectiveCommunicationSkill,KulbhusanKumar,RSSalaria,KhannaPublishingHouse.
5. LearningtoCommunicate–Dr.V.Chellammal, AlliedPublishingHouse,NewDelhi,2003

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	1	1	1	1	1	3	3	3	1	3	-	3	-	-	-
2	1	1	1	1	1	3	3	3	1	3	-	3	-	-	-
3	2	3	2	3	2	3	3	3	2	3	3	3	-	-	-
4	2	3	2	3	2	3	3	3	2	3	3	3	-	-	-
5	2	3	3	3	-	3	3	3	2	3	-	3	-	-	-
AVg.	**1.6**	**2.2**	**1.8**	**2.2**	**1.5**	**3**	**3**	**3**	**1.6**	**3**	**3**	**3**	**-**	**-**	**-**

1-low,2-medium,3-high,'-'-no correlation

21148S12 MATRICESANDCALCULUS LT P C

3 1 0 4

COURSEOBJECTIVES:

- To develop the use of matrix algebra techniques that areneeded byengineers for practical applications.
- Tofamiliarizethestudentswithdifferentialcalculus.
- Tofamiliarizethestudentwithfunctionsofseveralvariables. Thisisneededinmany branches of engineering.
- Tomakethestudentsunderstand varioustechniquesofintegration.
- Toacquaintthestudentwithmathematicaltoolsneededinevaluatingmultipleintegralsand their applications.

UNITI MATRICES 9+3

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors– Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications: Stretching of an elastic membrane.

UNITII DIFFERENTIALCALCULUS 9+3

Representation of functions - Limit of a function - Continuity- Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications: Maxima and Minima of functions of one variable.

UNITIII FUNCTIONSOFSEVERALVARIABLES 9+3

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables– Applications: Maxima and minima of functions of two variables and Lagrange'smethod of undetermined multipliers.

UNITIV INTEGRALCALCULUS 9+3

Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications:Hydrostaticforceand pressure, moments andcentres ofmass.

UNITV MULTIPLEINTEGRALS 9+3

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variablesin double and triple integrals – Applications: Moments and centres of mass, moment of inertia.

TOTAL:60PERIODS

COURSEOUTCOMES:

Attheendofthecoursethestudentswillbeableto

- Usethematrixalgebramethodsforsolvingpracticalproblems.
- Applydifferentialcalculustoolsinsolvingvariousapplicationproblems.
- Abletousedifferentialcalculusideasonseveralvariablefunctions.
- Applydifferentmethodsofintegrationinsolvingpracticalproblems.
- Applymultipleintegralideasinsolvingareas,volumesandotherpracticalproblems.

TE KS:

1. yszig.E, vanced ineering thematics", n ey and Sons, 10th Edition,NewDelhi,2016.
2. Grewal.B.S.,"Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition , 2018.
3. JamesStewart,"Calculus:EarlyTranscendentals",CengageLearning,8thEdition,New

Delhi,2015.[ForUnitsII&IV-Sections1.1,2.2,2.3,2.5,2.7(Tangentsproblemsonly), 2.8,3.1to3.6,3.11,4.1,4.3,5.1(Areaproblemsonly),5.2,5.3,5.4(excludingnetchange theorem),5.5,7.1 -7.4and 7.8].

REFERENCES:

1. Anton.H,Bivens.IandDavis.S,"Calculus",Wiley,10th Edition,2016
2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media(An imprint ofLakshmi Publications Pvt.,Ltd.,), NewDelhi, 7th Edition, 2009.
3. Jain.R.K. and Iyengar.S.R.K.,"Advanced Engineering Mathematics",Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan.S.andManicavachagomPillai.T.K.,"Calculus"VolumeIandII, S.ViswanathanPublishersPvt.Ltd.,Chennai,2009.
5. Ramana.B.V.,"HigherEngineering Mathematics", McGraw Hill Education Pvt.Ltd, New Delhi, 2016.
6. Srimantha Paland Bhunia.S.C,"EngineeringMathematics"Oxford UniversityPress, 2015.
7. Thomas.G.B.,Hass.J, and Weir.M.D, "Thomas Calculus",14th Edition,Pearson India, 2018.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
2	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
3	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
4	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
5	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-

1-low,2-medium,3-high,'-'-no correlation

21149S13 ENGINEERINGPHYSICS L TPC 3003

COURSEOBJECTIVES:

- Tomakethe studentseffectivelyachieveanunderstandingofmechanics.
- Toenablethestudentstogainknowledgeofelectromagneticwavesanditsapplications.
- Tointroducethebasicsofoscillations,opticsand lasers.
- Equippingthestudentsto successfullyunderstandtheimportanceofquantumphysics.
- Tomotivatethestudentstowardstheapplications ofquantum mechanics.

UNITI MECHANICS 9

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of the system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment ofinertia- theorems ofM .I –moment of inertia of continuous bodies –

ofadiatomicmolecule-torque–rotationaldynamicsof rigidbodies–conservationofangular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum

–doublependulum–Introductiontononlinearoscillations.

UNIT II ELECTROMAGNETICWAVES 9

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions onthe wave field- propertiesofelectromagneticwaves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission ofelectromagneticwavesfromanon-conductingmedium-vacuuminterfacefornormal

incidence.

UNIT III OSCILLATIONS,OPTICSANDLASERS 9

Simple harmonic motion - resonance –analogy between electrical and mechanical oscillatingsystems - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect.Reflection and refraction of light waves- total internal reflection - interference –Michelson interferometer –Theory of air wedge and experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO_2laser, semiconductor laser –Basic applications of lasers in industry.

UNIT IV BASICQUANTUMMECHANICS 9

Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes-Normalization, probabilities and the correspondence principle.

UNITV APPLIEDQUANTUMMECHANICS 9

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch's theoremfor particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

TOTAL:45PERIODS

COURSE OUTCOMES:

Aftercompletionofthiscourse,thestudentsshouldbeableto

- Understandtheimportanceofmechanics.
- Expresstheirknowledgeinelectromagneticwaves.
- Demonstrateastrongfoundationalknowledgeinoscillations,opticsand lasers.
- Understandtheimportanceofquantumphysics.
- Comprehendandapplyquantummechanicalprinciplestowardstheformationofenergy bands.

TEXTBOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (IndianEdition), 2017.
2. E.M.PurcellandD.J.Morin,ElectricityandMagnetism, CambridgeUniv.Press, 2013.
3. Arthur Beiser,Shobhit Mahajan,S. RaiChoudhury, Concepts ofModernPhysics, McGraw-Hill (Indian Edition), 2017.

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition),2009.
2. PaulA.Tipler,Physic–Volume1&2,CBS,(IndianEdition),2004.
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4. D.Halliday,R.ResnickandJ.Walker.PrinciplesofPhysics,Wiley(IndianEdition), 2015.

5. N.Garcia,A.DamaskandS.Schwarz.PhysicsforComputer ScienceStudents.Springer- Verlag, 2012.

CO	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO3
1	3	3	2	1	1	1	-	-	-	-	-	-	-	-	-
2	3	3	2	1	2	1	-	-	-	-	-	-	-	-	-
3	3	3	2	2	2	1	-	-	-	-	-	1	-	-	-
4	3	3	1	1	2	1	-	-	-	-	-	-	-	-	-
5	3	3	1	1	2	1	-	-	-	-	-	-	-	-	-
CO	3	3	1.6	1.2	1.8	1	-	-	-	-	-	1	-	-	-

1-low,2-medium,3-high,'-'-no correlation

21149S14 ENGINEERINGCHEMISTRY L TPC 3003

COURSEOBJECTIVES:

- To inculcate sound understanding of water quality parameters and water treatmenttechniques.
- Toimpartknowledgeonthebasicprinciplesandpreparatorymethodsofnanomaterials.
- Tointroducethebasicconceptsandapplicationsofphaseruleandcomposites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- Tofamiliarizethestudentswiththeoperatingprinciples,workingprocessesand applications of energy conversion and storage devices.

UNITI WATERANDITS TREATMENT 9

Water: Sources and impurities, Water quality parameters: Definition and significance of- color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water: Reverse Osmosis. Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming & foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment
–Ionexchangedemineralizationandzeoliteprocess.

UNITII NANOCHEMISTRY 9

Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types ofnanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNITIII PHASERULEANDCOMPOSITES 9

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.

Composites: Introduction: Definition & Need for composites;Constitution:Matrixmaterials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNITIVFUELSANDCOMBUSTION **9**

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleumand Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil

-cetanenumber;Poweralcoholandbiodiesel.

Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO_2emissionand carbon footprint.

UNITVENERGYSOURCESANDSTORAGEDEVICES **9**

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion- battery; Electric vehicles - working principles; Fuel cells: H_2-O_2 fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecourse,thestudentswillbeable:

- To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
- Toidentify andapplybasicconceptsofnanoscienceandnanotechnologyindesigning the synthesis of nanomaterials for engineering and technology applications.
- To applythe knowledge ofphaserule and composites for material selection requirements.
- Torecommendsuitablefuelsforengineeringprocessesandapplications.
- Torecognizedifferentformsofenergyresourcesandapplythemforsuitable applications in energy sectors.

TEXTBOOKS:

1. P. C. Jain and Monica Jain, “Engineering Chemistry”, 17th Edition, Dhanpat Rai PublishingCompany (P) Ltd, New Delhi, 2018.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, NewDelhi, 2008.

3. S.S. Dara, “A Text book of Engineering Chemistry”, S. Chand Publishing, 12thEdition,2018

REFERENCES:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Text book of nanoscience and nanotechnology”, Universities Press-IIM Series in Metallurgyand Materials Science, 2018.
2. O.G. Palanna, “EngineeringChemistry”McGraw Hill Education (India)Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, “Engineering Chemistry”, Scientific International PVT, LTD, New Delhi, 2014.
4. ShikhaAgarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, Second Edition, 2019.
5. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	2	1	1	1	-	-	-	-	-	-	-	-	-
2	3	3	2	1	2	1	-	-	-	-	-	-	-	-	-
3	3	3	2	2	2	1	-	-	-	-	-	1	-	-	-
4	3	3	1	1	2	1	-	-	-	-	-	-	-	-	-
5	3	3	1	1	2	1	-	-	-	-	-	-	-	-	-
CO	3	3	1.6	1.2	1.8	1	-	-	-	-	-	1	-	-	-

1-low,2-medium,3-high,‘-’-no correlation

21150S15 PROBLEMSOLVINGANDPYTHONPROGRAMMING L C
3 0

COURSEOBJECTIVES:

- Tounderstandthebasicsofalgorithmicproblemsolving.
- TolearntosolveproblemsusingPythonconditionalsandloops.
- TodefinePythonfunctionsandusefunctioncallstosolveproblems.
- TousePythondatastructures-lists,tuples,dictionariestorepresentcomplexdata.
- Todoinput/outputwithfilesinPython.

UNITI COMPUTATIONALTHINKINGANDPROBLEMSOLVING 9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocksofalgorithms(statements,state,controlflow,functions),notation(pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNITII DATATYPES,EXPRESSIONS,STATEMENTS 9

Pythoninterpreterandinteractivemode,debugging;valuesandtypes:int,float,boolean,string , and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNITIII CONTROLFLOW,FUNCTIONS,STRINGS 9

Conditionals:Boolean valuesandoperators,conditional(if),alternative(if-else),chainedconditional (if-elif-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.

UNITIV LISTS,TUPLES,DICTIONARIES 9

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.

UNITV FILES,MODULES,PACKAGES 9

Files and exceptions: text files, reading and writing files, format operator; commandlinearguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

TOTAL:45PERIODS

COURSEOUTCOMES:

Uponcompletionofthecourse,studentswillbeableto

CO1:Developalgorithmicsolutionstosimplecomputationalproblems.

CO2:DevelopandexecutesimplePythonprograms.
CO3:WritesimplePythonprogramsusingconditionalsandloopsforsolvingproblems. CO4: Decompose a Python program into functions.

CO5:RepresentcompounddatausingPythonlists,tuples,dictionariesetc. CO6: Read and write data from/to files in Python programs.

TEXTBOOKS:

1. Allen B. Downey, "Think Python: Howto Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "ComputationalThinking: A Beginner's Guide to ProblemSolving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. PaulDeitelandHarveyDeitel,"PythonforProgrammers",PearsonEducation,1st Edition,2021.
2. GVenkatesh andMadhavan Mukund,"Computational Thinking:A PrimerforProgrammersand Data Scientists", 1st Edition, Notion Press, 2021.
3. JohnVGuttag, "Introductionto Computationand ProgrammingUsingPython: WithApplicationsto Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
4. EricMatthes,"PythonCrashCourse,AHands -onProjectBasedIntroductiontoProgramming",2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. MartinC.Brown,"Python:TheCompleteReference",4thEdition,Mc-GrawHill,2018.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	-	-	-	-	-	2	2	3	3	-
2	3	3	3	3	2	-	-	-	-	-	2	2	3	-	-
3	3	3	3	3	2	-	-	-	-	-	2	-	3	-	-
4	2	2	-	2	2	-	-	-	-	-	1	-	3	-	-
5	1	2	-	-	1	-	-	-	-	-	1	-	2	-	-
6	2	2	-	-	2	-	-	-	-	-	1	-	2	-	-
Avg	**2**	**3**	**3**	**3**	**2**						**2**	**2**	**3**	**3**	

1-low,2-medium,3-high,'-'-no correlation

21150L16 PROBLEMSOLVINGANDPYTHONPROGRAMMINGLABORATORY LTPC
0042

COURSEOBJECTIVES:

- Tounderstandtheproblemsolvingapproaches.
- TolearnthebasicprogrammingconstructsinPython.
- TopracticevariouscomputingstrategiesforPython-basedsolutionstorealworldproblems.
- TousePythondatastructures-lists,tuples, dictionaries.
- Todoinput/output withfiles inPython.

EXPERIMENTS:

Note:Theexamplessuggested ineachexperimentareonlyindicative. Thelab instructor isexpectedtodesignother problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

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.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. ScientificproblemsusingConditionals andIterativeloops. (Numberseries,NumberPatterns, 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)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. ImplementingprogramsusingFunctions.(Factorial,largestnumberinalist,areaofshape)
7. ImplementingprogramsusingStrings.(reverse,palindrome,charactercount,replacingcharacters)
8. Implementing programs using writtenmodulesandPythonStandard Libraries(pandas,numpy. Matplotlib, scipy)
9. Implementingreal-time/technicalapplicationsusingFilehandling.(copyfromonefiletoanother, word count, longest word)
10. Implementingreal-time/technicalapplicationsusingExceptionhandling.(dividebyzeroerror,voter's age validity, student mark range validation)
11. ExploringPygametool.
12. DevelopingagameactivityusingPygamelikebouncingball,carraceetc.

TOTAL:60PERIODS

COURSEOUTCOMES:

Oncompletionofthecourse,studentswillbeable to:

CO1:Developalgorithmicsolutionstosimplecomputationalproblems

CO2: Develop and execute simple Python programs.

CO3:ImplementprogramsinPythonusingconditionalsandloopsforsolvingproblems. CO4: Deploy functions to decompose a Python program.
CO5:ProcesscompounddatausingPythondatastructures.
CO6:UtilizePythonpackagesindevelopingsoftwareapplications.

TEXTBOOKS:

1. Allen B. Downey, "Think Python: Howto Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to ProblemSolving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. PaulDeitelandHarveyDeitel,"PythonforProgrammers",PearsonEducation,1st Edition,2021.
2. GVenkatesh andMadhavan Mukund,"Computational Thinking:A PrimerforProgrammersand Data Scientists", 1st Edition, Notion Press, 2021.
3. JohnVGuttag,"IntroductiontoComputationandProgrammingUsingPython:WithApplicationsto Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021.
4. EricMatthes,"PythonCrashCourse,AHands -onProjectBased IntroductiontoProgramming",2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. MartinC.Brown,"Python:TheCompleteReference",4thEdition,Mc-GrawHill,2018.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	3	3	3	1	-	-	-	-	3	2	3	3	-
2	3	3	3	3	3	1	-	-	-	-	3	2	3	-	-
3	3	3	3	3	2	1	-	-	-	-	2	-	3	-	-
4	3	2	-	2	2	1	-	-	-	-	1	-	3	-	-
5	1	2	-	-	1	1	-	-	-	-	1	-	2	-	-
6	2	-	-	-	2						1	-	2	-	
AVg.	**2**	**3**	**3**	**3**	**2**	1	-	-	-	-	**2**	**2**	**3**	**3**	-

1-low,2-medium,3-high,'-'-no correlation

21149L17 PHYSICSANDCHEMISTRYLABORATORY LTPC0042

PHYSICS LABORATORY:(AnySeven Experiments)

COURSEOBJECTIVES:

- Tolearnthe proper useofvariouskindsofphysicslaboratoryequipment.
- Tolearnhowdatacanbecollected,presentedandinterpretedinaclearandconcisemanner.
- Tolearnproblemsolvingskillsrelatedtophysicsprinciplesandinterpretationofexperimental data.
- Todetermineerrorinexperimentalmeasurementsandtechniquesusedtominimizesucherror.
- Tomakethestudentanactiveparticipantineachpartofalllabexercises.

1. Torsionalpendulum-Determinationofrigiditymodulusofwireand momentofinertiaof regular and irregular objects.
2. Simpleharmonicoscillationsofcantilever.
3. Non-uniformbending-DeterminationofYoung'smodulus
4. Uniformbending–DeterminationofYoung'smodulus
5. Laser-Determinationofthewavelengthofthelaserusing grating

6. Air wedge-Determinationofthicknessofathinsheet/wire
7. a)Opticalfibre-DeterminationofNumericalApertureandacceptanceangle
   b)Compactdisc-Determinationofwidthofthegrooveusinglaser.
8. Acousticgrating-Determinationofvelocityofultrasonicwavesinliquids.
9. Ultrasonicinterferometer–determinationofthevelocityofsoundandcompressibilityofliquids
10. PostofficeBox-DeterminationofBandgapofasemiconductor.
11. Photoelectriceffect
12. MichelsonInterferometer.
13. Melde'sstringexperiment
14. Experiment withlatticedynamics kit.

TOTAL:30PERIODS

COURSEOUTCOMES:

Uponcompletionofthecourse,thestudentsshouldbeableto

- Understandthefunctioningofvariousphysicslaboratoryequipment.
- Usegraphicalmodelstoanalyzelaboratorydata.
- Usemathematicalmodelsasamediumforquantitativereasoningand describingphysicalreality.
- Access,processandanalyzescientificinformation.
- Solveproblemsindividuallyandcollaboratively.

CHEMISTRYLABORATORY:(Anysevenexperimentstobeconducted)

COURSE OBJECTIVES:

- Toinculcateexperimentalskillstotest basicunderstandingofwaterqualityparameters,suchas, acidity, alkalinity, hardness, DO, chloride and copper.
- Toinducethestudentstofamiliarizewithelectroanalyticaltechniquessuchas,pHmetry, potentiometryandconductometryinthedeterminationofimpuritiesinaqueoussolutions.
- Todemonstratetheanalysisofmetalsandalloys.
- Todemonstratethesynthesisofnanoparticles

1. Preparation of Na_2CO_3 asaprimarystandardandestimationofacidityofawatersample using the primary standard
2. Determinationoftypesandamount ofalkalinityinawatersample.
- Splitthefirstexperimentintotwo
3. Determinationoftotal,temporary&permanenthardnessofwaterbyEDTAmethod.
4. DeterminationofDOcontentofwatersamplebyWinkler's method.
5. Determinationofchloridecontentofwatersample byArgentometricmethod.
6. EstimationofcoppercontentofthegivensolutionbyIodometry.
7. EstimationofTDSofa watersamplebygravimetry.
8. Determinationofstrengthofgivenhydrochloricacidusingp H meter.
9. Determinationofstrengthofacidsinamixtureofacidsusingconductivitymeter.
10. Conductometrictitrationofbariumchlorideagainstsodiumsulphate(precipitationtitration)
11. Estimationofironcontentofthegivensolutionusing potentiometer.
12. Estimationofsodium/potassiumpresentinwaterusingaflame photometer.
13. Preparationofnanoparticles(TiO_2/ZnO/CuO)bySol-Gelmethod.
14. EstimationofNickelinsteel
15. ProximateanalysisofCoal

TOTAL:30PERIODS

COURSEOUTCOMES:

- Toanalysethequalityofwatersampleswithrespecttotheiracidity,alkalinity,hardnessandDO.
- Todeterminetheamount ofmetalionsthroughvolumetricandspectroscopic techniques
- Toanalyseanddetermine thecompositionofalloys.
- Tolearnsimplemethodofsynthesisofnanoparticles
- Toquantitativelyanalysetheimpuritiesinsolutionbyelectroanalyticaltechniques

TEXTBOOKS:

1. J.Mendham,R.C.Denney,J.D.Barnes,M.ThomasandB.Sivasankar,Vogel' Textbookof Quantitative Chemical Analysis (2009).

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	2	3	1	1	1	-	-	-	-	-	-	-	-	-
2	3	3	2	1	1	1	-	-	-	-	-	-	-	-	-
3	3	2	3	1	1	1	-	-	-	-	-	-	-	-	-
4	3	3	2	1	1	1	-	-	-	-	-	-	-	-	-
5	3	2	3	1	1	1	-	-	-	-	-	-	-	-	-
CO	3	2.4	2.6	1	1	1	-	-	-	-	-	-	-	-	-

1-low,2-medium,3-high,'-'-no correlation

21147S21 PROFESSIONALENGLISH-II LTPC

20 02

COURSEOBJECTIVES:

- To engage learnersin meaningful language activitiesto improvetheir readingand writing skills
- To learn various reading strategies and apply in comprehending documents in professional context.
- Tohelp learnersunderstandthepurpose,audience,contextsofdifferenttypesofwriting
- Todevelopanalyticalthinkingskillsforproblemsolvingincommunicative contexts
- Todemonstrateanunderstandingofjobapplicationsandinterviewsforinternshipand placements

UNITI MAKINGCOMPARISONS 6

Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases

UNITIIEXPRESSINGCAUSALRELATIONSINSPEAKINGANDWRITING 6

Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds

UNITIII PROBLEMSOLVING6

Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences

UNITIV REPORTINGOFEVENTSANDRESEARCH6

Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions

UNITV THEABILITYTOPUTIDEASORINFORMATIONCOGENTLY6

Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numericaladjectives, Relative Clauses.

TOTAL:30PERIODS

COURSEOUTCOMES:

Attheendofthecourse,learnerswillbeable

CO1:Tocompareandcontrastproductsandideasintechnicaltexts.

CO2:To identify and report cause and effects in events, industrial processes through technicaltexts

CO3:Toanalyseproblemsinordertoarriveatfeasiblesolutionsandcommunicatethemin thewritten format.

CO4:Topresenttheirideasandopinionsinaplannedandlogicalmanner

CO5:Todrafteffectiveresumesinthecontextofjobsearch.

TEXTBOOKS :

1. EnglishforEngineers&Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. EnglishforScience&TechnologyCambridgeUniversityPress2021.
3. Authored byDr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa MaryFrancis, Dr. KN.Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCEBOOKS:

1. Raman. Meenakshi, Sharma. Sangeeta (2019). ProfessionalEnglish. Oxford universitypress. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.
3. LearningtoCommunicate–Dr.V.Chellammal.AlliedPublishers,NewDelhi,2003
4. BusinessCorrespondence and Report Writing byProf. R.C. Sharma &Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd.1990, Delhi.

ASSESSMENTPATTERN

Two internal assessments and an end semester examination to test students' reading and writingskills along with their grammatical and lexical competence.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
2	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
3	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
4	3	3	3	3	2	3	3	3	2	3	3	3	-	-	-
5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	-	-	-
CO	**3**	**3**	**3**	**3**	**.75**	**3**	**3**	**3**	**.2**	**3**	**3**	**3**	-	-	-

1-low,2-medium,3-high,'-"-nocorrelation

Note: Theaveragevalueofthiscoursetobeusedforprogramarticulationmatrix.

21148S22 STATISTICSANDNUMERICAL METHODS LTPC
3104

COURSEOBJECTIVES:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kindsof problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- Tointroducethebasicconceptsofsolvingalgebraicandtranscendentalequations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNITI TESTINGOFHYPOTHESIS 9+3

Sampling distributions - Tests for single mean,proportion and difference of means (Large and

small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit –Independence of attributes.

UNITII DESIGNOFEXPERIMENTS 9+3

One way and two way classifications - Completely randomized design – Randomized block design –Latin square design - 2^2 factorial design.

UNITIII SOLUTIONOFEQUATIONSANDEIGENVALUEPROBLEMS 9+3

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT IV INTERPOLATION,NUMERICALDIFFERENTIATIONANDNUMERICAL INTEGRATION 9 +3

Lagrange's and Newton's divided difference interpolations – Newton's forwardand backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal andSimpson's1/3 rules.

UNITV NUMERICALSOLUTIONOFORDINARYDIFFERENTIALEQUATIONS9+3

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

TOTAL:60PERIODS

COURSEOUTCOMES:

Uponsuccessfulcompletionofthecourse,studentswillbeableto:

CO1:Apply the concept of testing of hypothesis for small and large samples in real life problems.CO2:Applythebasicconceptsofclassificationsofdesignofexperimentsinthe fieldofagriculture. CO3:Appreciate the numerical techniques of interpolation in various intervals and apply thenumerical techniques of differentiation andintegration for engineering problems.

CO4:Understand the knowledge ofvarious techniques and methods for solvingfirst andsecondorder ordinary differential equations.

CO5:Solve thepartial andordinary differential equations with initial and boundary conditions byusing certain techniques with engineering applications.

TEXTBOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson,R.A.,Miller,IandFreundJ.,"MillerandFreund'sProbabilityandStatistics forEngineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCES:

1. Burden,R.LandFaires,J.D,"NumericalAnalysis",9th Edition,CengageLearning,2016.
2. Devore.J.L.,"ProbabilityandStatisticsforEngineeringandtheSciences",Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald.C.F. andWheatley. P.O. "AppliedNumericalAnalysis" PearsonEducation, Asia, New Delhi, 7th Edition, 2007.
4. Gupta S.C. and Kapoor V. K., "Fundamentals of MathematicalStatistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
6. Walpole.R.E., Myers. R.H., Myers. S.L. andYe.K.,"ProbabilityandStatisticsfor Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
2	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
3	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
4	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
5	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-

1-low,2-medium,3-high,'-"-nocorrelation

Note: Theaveragevalueofthiscoursetobeusedforprogramarticulationmatrix.

		L	T	P	C
21149S23B	**PHYSICSFORELECTRONICSENGINEERING**	**3**	**0**	**0**	**3**

COURSEOBJECTIVES:

- Tomakethestudentstounderstandthebasicsofcrystallographyanditsimportancein studying materials properties.
- Tounderstandtheelectricalpropertiesofmaterialsincludingfreeelectrontheory, applications of quantum mechanics and magnetic materials.
- Toinstilknowledgeonphysicsofsemiconductors,determinationofchargecarriersand device applications
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications
- To inculcate an idea of significance of nano structures, quantum confinement and ensuingnano device applications.

UNITI CRYSTALLOGRAPHY 9

Crystal structures: Crystal lattice – basis - unit cell and lattice parameters – crystal systems and Bravais lattices – Structure and packing fractions of SC, BCC, FCC, diamond cubic, NaCL, ZnS structures – crystal planes, directions and Miller indices – distance between successive planes – linear and planar densities – crystalline and noncrystalline materials – Example use of Miller indices: wafer surface orientation – wafer flats and notches – pattern alignment - imperfections in crystals.

UNITII ELECTRICALANDMAGNETICPROPERTIESOFMATERIALS 9

Classical free electron theory- Expression for electrical conductivity – Thermal conductivity, expression - Quantum free electron theory :Tunneling – degenerate states – Fermi- Dirac statistics

– Density of energy states – Electron in periodic potential – Energy bands in solids – tight binding approximation - Electron effective mass – concept of hole. Magnetic materials: Dia, para and ferromagnetic effects – paramagnetism in the conduction electrons in metals – exchange interaction and ferromagnetism – quantum interference devices – GMR devices.

UNITIII SEMICONDUCTORSANDTRANSPORTPHYSICS 9

Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature – Carrier transport in Semiconductors: Drift, mobility and diffusion – Hall effect and devices – Ohmiccontacts

–Schottkydiode.

UNITIV OPTICALPROPERTIESOFMATERIALS 9

Classification of optical materials – Optical processes in semiconductors: optical absorption and emission, charge injection and recombination, optical absorption, loss and gain. Optical

processes in quantum wells – Optoelectronic devices: light detectors and solar cells – light emitting diode – laser diode - optical processes in organic semiconductor devices –excitonic state – Electro-optics and nonlinear optics:Modulators and switching devices – plasmonics.

UNITV NANODEVICES 9

Densityof statesfor solids - Significance between Fermi energyand volume of the material – Quantum confinement – Quantum structures – Densityof states for quantum wells, wires and dots –Band gap of nanomaterials –Tunneling – Single electron phenomena – Single electron Transistor. Conductivityof metallic nanowires – Ballistic transport – Quantumresistance and conductance – Carbon nanotubes: Properties and applications - Spintronic devices and applications – Optics in quantum structures – quantum well laser.

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecourse,thestudentsshouldbeable to

CO1:knowbasicsofcrystallographyanditsimportanceforvariedmaterialsproperties **CO2**:gain knowledge on the electrical and magnetic properties of materials and their applications

CO3:understandclearlyofsemiconductorphysicsandfunctioningofsemiconductor devices

CO4:understandtheopticalpropertiesofmaterialsandworkingprinciplesofvarious optical devices

CO5:appreciatetheimportanceofnanotechnologyandnanodevices.

TEXTBOOKS:

1. S.O. Kasap. Principles of Electronic Materials and Devices, McGraw Hill Education (IndianEdition), 2020.
2. R.F.Pierret.SemiconductorDeviceFundamentals.Pearson(IndianEdition),2006.
3. G.W.Hanson.FundamentalsofNanoelectronics.PearsonEducation(IndianEdition),2009.

REFERENCES:

1. Laszlo Solymar,Walsh,Donald,Syms and Richard R.A., Electrical Properties ofMaterials, Oxford Univ. Press (Indian Edition) 2015.
2. JaspritSingh,SemiconductorOptoelectronics:PhysicsandTechnology,McGraw-Hill Education (Indian Edition), 2019.
3. CharlesKittel,IntroductiontoSolidStatePhysics,WileyIndiaEdition,2019.
4. MarkFox,OpticalPropertiesofSolids,OxfordUniv.Press,2001.
5. N.Gershenfeld.ThePhysicsofInformationTechnology.CambridgeUniversityPress,2011.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	-	1	-	-	-	-	-	-	-	-	-	-	-	-
2	3	2	1	2	-	2	-	-	-	-	-	-	-	-	-
3	3	2	2	-	2	-	-	-	-	-	-	-	-	-	-
4	3	-	1	-	3	2	3	-	-	-	-	1	-	-	-
5	3	-	2	1	-	2	-	-	-	-	-	1	-	-	-
CO	3	2	4	1.	2.5	2	3	-	-	-	-	1	-	-	-

1-low,2-medium,3-high,'-'-no correlation

21153S25B

ELECTRICALANDINSTRUMENTATIONENGINEERING LTPC

3003

COURSEOBJECTIVES:

- Toimpartknowledgeintypes,constructionandworkingoftransformers
- Toimpartknowledgeintypes,constructionandworkingofDC machines
- Toimpartknowledgeintypes,constructionandworkingofACrotatingmachines
- Tointroducethefunctionalelementsandworkingofmeasuringinstruments.
- Tointroducethebasicsofpowersystemand protectionschemes

UNITI TRANSFORMER 9

Introduction - Ideal and Practical Transformer – Phasor diagram-– Per Unit System – Equivalent circuit- Testing- Efficiency and Voltage Regulation– Three Phase Transformers – Applications- Auto Transformers, Advantages- Harmonics.

UNITII DCMACHINES 9

Introduction – Constructional Features– Motor and Generator mode - EMF and Torque equation – Circuit Model – Methods of Excitation- Characteristics – Starting and Speed Control – Universal Motor- Stepper Motors – Brushless DC Motors- Applications

UNITIII ACROTATINGMACHINES 9

Principle of operation of three-phase induction motors – Construction –Types – Equivalent circuit, Speed Control - Single phase Induction motors -Construction– Types– starting methods. Alternator: Working principle–Equation of induced EMF – Voltage regulation, Synchronous motors- working principle-starting methods – Torque equation.

UNITIV MEASUREMENTSANDINSTRUMENTATION 9

Functional elements of an instrument , Standards and calibration, Operating Principle , types - Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, InstrumentTransformers-CT andPT,DSO- Block diagram- Data acquisition.

UNITV BASICSOFPOWERSYSTEMS 9

Power system structure -Generation , Transmission and distribution , Various voltage levels, Earthing – methods of earthing, protective devices- switch fuse unit- Miniature circuit breaker- moulded case circuit breaker- earth leakage circuit breaker, safety precautions and First Aid

TOTAL:45PERIODS

COURSEOUTCOMES:

Aftercompletingthiscourse,thestudentswillbeableto

CO1: Explaintheworkingprincipleofelectricalmachines

CO2: Analyzetheoutputcharacterizesofelectricalmachines

CO3: Choose the appropriate electrical machines for various applications **CO4:** Explain the types and operating principles of measuring instruments **CO5:** Explain the basic powersystem structure and protection schemes

TEXTBOOKS:

1. KothariDP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition,McGraw Hill Education, 2020
2. S.K, Bhattacharya, "BasicElectricalandElectronicsEngineering", Second Edition, Pearson Education, 2017.
3. A.K.Sawhney,PuneetSawhney'ACourseinElectrical&ElectronicMeasurements&

Instrumentation',DhanpatRaiandCo,NewDelhi,2015.

4. C.L.Wadhwa,"Generation,DistributionandUtilisationofElectricalEnergy",NewAge International pvt.ltd.,2003

REFERENCES:

1. KothariDPandI.JNagrath,"BasicElectricalEngineering",FourthEdition, McGraw HillEducation, 2019
2. MahmoodNahviandJosephA.Edminister,"ElectricCircuits",Schaum'Outline Series,McGraw Hill, 2002.
3. H.S.Kalsi,'ElectronicInstrumentation',TataMcGraw-Hill,NewDelhi,2010

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
2	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
3	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
4	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
5	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
CO	**2**	**1**	**1**	-	-	-	-	**1**	-	-	-	-	-	-	-

1-low,2-medium,3-high,'-'-no correlation

21154S24 ENGINEERINGGRAPHICS LTP C
204 4

COURSEOBJECTIVES:

Themainlearningobjectiveofthiscourseistopreparethestudentsfor:

- Drawingengineeringcurves.
- Drawingfreehandsketchofsimpleobjects.
- Drawingorthographicprojectionofsolidsandsectionofsolids.
- Drawingdevelopmentofsolids
- Drawingisometricandperspectiveprojectionsofsimplesolids.

CONCEPTSANDCONVENTIONS(NotforExamination)

Importance of graphics in engineering applications — Use of drafting instruments — BIS conventions and specifications — Size, layout and folding of drawing sheets— Lettering and dimensioning.

UNIT I PLANECURVES 6+12

Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction ofinvolutes of square and circle — Drawing of tangents and normal to the above curves.

UNITII PROJECTIONOFPOINTS,LINESANDPLANESURFACE 6+12

Orthographic projection - principles - Principal planes-First angle projection-projection of points. Projectionof straight lines(onlyFirst angleprojections)inclinedto both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNITIII PROJECTIONOFSOLIDSANDFREEHANDSKETCHING 6+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles — Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.

Practicing three dimensional modeling of simple objects by CAD Software (Notfor examination)

UNITIV PROJECTIONOFSECTIONEDSOLIDSANDDEVELOPMENTOF SURFACES 6+12

Sectioning of above solids in simplevertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

Practicing three dimensional modeling of simple objects by CAD Software (Notfor examination)

UNITV ISOMETRICANDPERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection — isometric scale —Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objectsin simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination)

TOTAL:(L=30+P=60)90PERIODS

COURSEOUTCOMES:

On successful completion of this course, the student will be able to **CO1**:Use BIS conventions and specifications for engineering drawing.**CO2**:Constructtheconiccurves,involutesandcycloid.

CO3:Solve practical problems involving projection of lines.

CO4:Drawtheorthographic,isometricandperspectiveprojectionsofsimplesolids.

CO5:Drawthedevelopmentofsimplesolids.

TEXTBOOKS:

1.BhattN.D.andPanchal V.M.,"EngineeringDrawing",Charotar Publishing House, 53rd Edition,2019.

2. NatrajanK.V.,"ATextBookofEngineeringGraphics",DhanalakshmiPublishers, Chennai,2018.
3. Parthasarathy,N.S.andVelaMurali, "EngineeringDrawing",OxfordUniversityPress, 2015

REFERENCES:

1. BasantAgarwalandAgarwalC.M.,"EngineeringDrawing",McGrawHill,2nd Edition,2019.
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore,27th Edition,2017.
3. Luzzader, Warren.J. and Duff,John 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.
4. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5. ShahM.B.,andRanaB.C.,"EngineeringDrawing",PearsonEducationIndia,2nd Edition,2009.
6. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

PublicationofBureauofIndianStandards:

1. IS10711—2001:TechnicalproductsDocumentation—Sizeandlayoutofdrawingsheets.
2. IS9609(Parts0&1)—2001:TechnicalproductsDocumentation—Lettering.
3. IS10714(Part20)—2001&SP 46—2003:Lines fortechnicaldrawings.
4. IS11669—1986&SP46—2003:DimensioningofTechnicalDrawings.
5. IS15021(Parts1to4)—2001:Technicaldrawings—ProjectionMethods.

Special pointsapplicabletoUniversityExaminationsonEngineeringGraphics:

1. Therewillbefivequestions,eachofeitherortype coveringallunitsofthesyllabus.
2. Allquestionswill carryequalmarksof20eachmakingatotalof100.
3. Theanswerpapershallconsistofdrawingsheetsof A3sizeonly. Thestudentswillbe permitted to useappropriate scale to fit solution within A3 size.
4. Theexaminationwillbeconductedinappropriatesessionsonthesameday

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
2	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
3	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
4	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
5	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
CO	**3**	**1**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**2**	**2**	**2**	**-**

1-low,2-medium,3-high,'-'-no correlation

21153S26A

CIRCUITANALYSIS LTPC

310 4

COURSEOBJECTIVES:

- TolearnthebasicconceptsandbehaviourofDCandAC circuits.
- Tounderstandvariousmethodsofcircuit/networkanalysisusingnetworktheorems.
- Tounderstandthetransient andsteadystateresponseofthecircuitssubjectedtoDC excitations and AC with sinusoidal excitations.
- Tolearntheconcept ofcouplingincircuitsandtopologies.

UNIT I DCCIRCUITANALYSIS 12

Basic Components of electric Circuits, Charge, current, Voltage and Power, Voltage and Current Sources, Ohms Law, Kirchoff‘s Current Law, Kirchoff‘s voltage law, The single Node – Pair Circuit, series and Parallel Connected Independent Sources, Resistors in Series and Parallel, voltage and current division, Nodal analysis, Mesh analysis.

UNITII NETWORKTHEOREMANDDUALITY 12

Useful Circuit Analysis techniques - Linearity and superposition, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion. Duals, Dual circuits. Analysis using dependent current sources and voltage sources

UNITIII SINUSOIDALSTEADYSTATEANALYSIS 12

Sinusoidal Steady – State analysis , Characteristics of Sinusoids, The Complex Forcing Function, The Phasor, Phasor relationship for R, L, and C, impedance and Admittance, Nodal and Mesh Analysis, Phasor Diagrams, AC Circuit Power Analysis, Instantaneous Power, Average Power,apparent Power and Power Factor, Complex Power.

UNITIV TRANSIENTSANDRESONANCEINRLCCIRCUITS 12

Basic RL and RC Circuits, The Source- Free RL Circuit, The Source-Free RC Circuit, The Unit-Step Function, Driven RL Circuits, Driven RC Circuits, RLC Circuits, Frequency Response, Parallel Resonance, Series Resonance, Quality Factor.

UNIT V COUPLEDCIRCUITSANDTOPOLOGY 12

Magnetically Coupled Circuits, mutual Inductance, the Linear Transformer, the Ideal Transformer, Anintroduction to Network Topology, Trees and General Nodal analysis, Links and Loop analysis.

SUGGESTEDACTIVITIES:

- Practicesolvingvarietyofproblems

COURSEOUTCOMES

Onsuccessfulcompletionofthiscourse,thestudentwillbeableto

CO1: Apply thebasicconceptsofcircuitanalysissuchasKirchoff’slaws,mesh currentandnode voltage method for analysis of DC and AC circuits.

CO2: ApplysuitablenetworktheoremsandanalyzeACandDCcircuits

CO3: AnalyzesteadystateresponseofanyR,LandCcircuits

CO4: Analyze the transient response for anyRC, RL and RLC circuits and frequency responseof parallel and series resonance circuits.

CO5: Analyzethecoupledcircuitsandnetworktopologies

TOTAL:60PERIODS

TEXTBOOKS:

1. Hayt JackKemmerly, StevenDurbin, "Engineering Circuit Analysis",McGrawHill education,9th Edition, 2018.
2. Charles K. Alexander &Mathew N.O.Sadiku, "Fundamentals ofElectric Circuits", Mc Graw-Hill, 2nd Edition, 2003.
3. Joseph Edminister and Mahmood Nahvi, ―Electric Circuits, Schaum‘s Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

REFERENCES:

1. Robert.L. Boylestead, "IntroductoryCircuit Analysis", Pearson Education India, 12th Edition, 2014. David Bell, "Fundamentals of Electric Circuits", Oxford University press, 7thEdition, 2009.
2. John O Mallay, Schaum’s Outlines "Basic Circuit Analysis", The Mc Graw Hill companies, 2nd Edition, 2011
3. Allan H.Robbins, Wilhelm C.Miller, “Circuit Analysis Theory and Practice", Cengage Learning, Fifth Edition, 1st Indian Reprint 2013

CO’s-PO’s&PSO’sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	1		1	-	-	-	-	-
2	3	3	2	2	-	-	-	1		1	-	-	-	-	-
3	3	3	3	3	-	-	-	1		1	-	-	-	-	-
4	3	3	3	3	-	-	-	1		1	-	-	-	-	-
5	3	3	3	2	-	-	-	1		1	-	-	-	-	-
CO	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**1**		**1**	**-**	**-**	-	-	-

1-low,2-medium,3-high,‘-'-no correlation

21154L21

ENGINEERINGPRACTICESLABORATORY LTPC

0042

COURSEOBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints inwoodmaterialsusedin commonhousehold wood work.
- Wiringvariouselectricaljointsincommonhouseholdelectricalwirework.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanicalassemblyofcommonhouseholdequipments;Makingatrayoutof

metalsheet usingsheetmetalwork.

- Solderingandtestingsimpleelectroniccircuits;Assemblingandtestingsimple electronic components on PCB.

GROUP–A(CIVIL&ELECTRICAL)

PARTI CIVILENGINEERINGPRACTICES **15**

PLUMBINGWORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions,reducers,elbowsandothercomponentswhicharecommonly used in household.
b) Preparingplumbinglinesketches.
c) Layingpipe connectiontothesuctionsideofapump
d) Layingpipeconnectiontothedeliverysideofapump.
e) Connectingpipesofdifferentmaterials:Metal,plasticand flexiblepipesusedinhousehold appliances.

WOODWORK:

a) Sawing,
b) Planingand
c) MakingjointslikeT-Joint,MortisejointandTenonjointandDovetailjoint.

WoodWorkStudy:

a) Studyingjointsindoorpanelsandwoodenfurniture
b) Studyingcommonindustrialtrussesusingmodels.

PARTII ELECTRICALENGINEERINGPRACTICES **15**

a) Introductiontoswitches, fuses, indicatorsandlamps-Basicswitchboardwiring with lamp, fan and three pin socket
b) Staircasewiring
c) FluorescentLampwiringwithintroductiontoCFLandLEDtypes.
d) Energymeterwiringandrelatedcalculations/calibration
e) StudyofIronBoxwiringandassembly
f) StudyofFanRegulator(ResistortypeandElectronictypeusingDiac/Triac/quadrac)
g) Studyofemergencylampwiring/Waterheater

GROUP–B(MECHANICALANDELECTRONICS)

PARTIII MECHANICALENGINEERINGPRACTICES **15**

WELDINGWORK:

a) WeldingofButt Joints, LapJoints,andTeeJointsusingarcwelding.
b) Practicinggaswelding.

BASICMACHINING WORK:

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLYWORK:

a) Assemblingacentrifugalpump.
b) Assemblingahouseholdmixer.
c) Assemblinganairconditioner.

SHEETMETALWORK:

a)Makingofasquaretray

FOUNDRYWORK:

a)Demonstratingbasicfoundryoperations.

PARTIV ELECTRONICENGINEERINGPRACTICES 15

SOLDERINGWORK:

a)Solderingsimpleelectroniccircuitsandcheckingcontinuity.

ELECTRONICASSEMBLY ANDTESTINGWORK:

a)Assemblingandtestingelectroniccomponentsonasmall PCB.

ELECTRONICEQUIPMENTSTUDY:

a) Studyan elements ofsmartphone..
b) AssemblyanddismantleofLEDTV.
c) Assemblyand dismantleofcomputer/laptop

COURSEOUTCOMES:

Uponcompletionofthiscourse,thestudentswillbeableto:TOTAL:60PERIODS

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

CO2:Wirevariouselectricaljointsincommonhouseholdelectricalwirework.

CO3:Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.

CO4:Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
2	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
3	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
CO	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1

1-low,2-medium,3-high,'-'-no correlation

21153L22A

CIRCUIT ANALYSIS LABORATORY

L T P C
0 0 2 1

COURSEOBJECTIVES:

- Togainhands-onexperienceinThevenin&Nortontheorem,KVL&KCL, andSuperposition Theorems.
- TounderstandtheworkingofRL,RC andRLCcircuits

ListofExperiments:

1. VerificationsofKVL&KCL.
2. VerificationsofThevenin &Nortontheorem.
3. VerificationofSuperpositionTheorem.
4. Verificationofmaximumpowertransfer Theorem
5. DeterminationofResonance FrequencyofSeries&ParallelRLCCircuits.
6. TransientanalysisofRLand RCcircuits.

TOTAL:30PERIODS

COURSEOUTCOMES:

Attheendofthecourse,thestudentwillbeableto

- DesignRLandRC circuits.
- VerifyThevinin &NortontheoremKVL&KCL,andSuper PositionTheorems.

TEXTBOOKS

1. HaytJackKemmerly,StevenDurbin,"EngineeringCircuitAnalysis",McGrawHill education,9th Edition, 2018.
2. Charles K. Alexander & Mathew N.O.Sadiku, "Fundamentals of Electric Circuits", McGraw- Hill, 2nd Edition, 2003.
3. Joseph Edminister and Mahmood Nahvi, “Electric Circuits, Schaum‘s Outline Series”, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

REFERENCES

1. DavidBell,"FundamentalsofElectricCircuits",OxfordUniversitypress,7th Edition, 2009
2. JohnOMallay,Schaum’sOutlines"BasicCircuit Analysis",TheMcGrawHillcompanies, 2nd Edition, 2011.
3. A.BruceCarlson,“Cicuits:EngineeringConceptsandAnalysisofLinearElectric Circuits,Cengage Learning, India Edition 2nd Indian Reprint 2009.
4. AllanH.Robbins,WilhelmC.Miller,“CircuitAnalysisTheoryand Practice”,Cengage Learning, Fifth Edition, 1st Indian Reprint 2013

CO’s-PO’s&PSO’sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	**3**	**2**	**1**	**1**				**1**	**-**	**1**	**-**		**-**	**-**	**-**
2	**3**	**3**	**2**	**2**				**1**	**-**	**1**	**-**		**-**	**-**	**-**
3	**3**	**3**	**3**	**3**				**1**	**-**	**1**	**-**		**-**	**-**	**-**
4	**3**	**3**	**3**	**3**				**1**	**-**	**1**	**-**		**-**	**-**	**-**
5	**3**	**3**	**3**	**3**				**1**		**1**					

CO	3	3	1.6	1.2	1.8	1	-	-	-	-	-	1	-	-	-

1-low,2-medium,3-high,'-'-no correlation

21147L23

COMMUNICATIONLABORATORY LTPC

0042

COURSEOBJECTIVES:

- Toidentifyvaried groupdiscussionskillsandapplythemtotakepartineffectivediscussions in a professional context.
- Toanalyseconceptsandproblemsandmakeeffectivepresentationsexplainingthemclearly and precisely.
- Tobeabletocommunicateeffectivelythroughformalandinformalwriting.
- Tobeabletouseappropriatelanguagestructurestowriteemails,reportsandessays
- Togiveinstructionsandrecommendationsthat areclear andrelevant tothe context

UNITI **12**

Speaking-Role Play Exercises Based on Workplace Contexts, - talking about competition- discussing progress toward goals-talking about experiences- talkingabout events in life- discussing past events-Writing: writing emails (formal & semi-formal).

UNITII **12**

Speaking: discussing news stories-talking about frequency-talking about travel problems- discussingtravel procedures- talking about travel problems- making arrangements-describing arrangements- discussing plans and decisions- discussing purposes and reasons-understanding common technology terms-Writing: - writing different types of emails.

UNITIII **12**

Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios- talking about purchasing-discussing advantages and disadvantages- making comparisons- discussing likes and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.

UNITIV **12**

Speaking: discussing the natural environment-describing systems-describing position and movement- explaining rules-(example- discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article.

UNITV **12**

Speaking: describing things relatively-describing clothing-discussing safety issues(making recommendations) talking about electrical devices-describing controlling actions-Writing:

jobapplication(Coverletter+Curriculumvitae)-writingrecommendations.

TOTAL:60PERIODS

LEARNINGOUTCOMES

CO1:Speakeffectivelyingroupdiscussionsheldinformal/semiformalcontexts.

CO2:Discuss,analyseandpresentconceptsandproblemsfromvariousperspectivesto arrive atsuitable solutions

CO3:Writeemails,lettersandeffectivejobapplications.

CO4:Writecriticalreportstoconveydataandinformationwithclarityandprecision

CO5:Giveappropriateinstructionsandrecommendationsforsafeexecutionoftasks

AssessmentPattern

- Oneonline/appbasedassessmenttotestspeakingandwritingskills
- Proficiencycertification isgivenonsuccessfulcompletionofspeakingand writing.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	3	3	1	3	3	3	3	3	3	3	-	-	
2	2	3	3	3	1	3	3	3	3	3	3	3	-	-	
3	2	2	3	3	1	3	3	3	3	3	3	3	-	-	
4	3	3	3	3	3	3	3	3	3	3	3	3	-	-	
5	3	3	3	3	3	3	3	3	3	3	3	3	-	-	
Vg.	**2.**	**2.8**	**3**	**3**	**1.8**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	

1-low,2-medium,3-high,'-"-nocorrelation

- **Note:**Theaveragevalueofthiscoursetobeusedforprogramarticulationmatrix.

21148S31B RANDOMPROCESSESANDLINEARALGEBRA LTPC
3104

COURSEOBJECTIVES:

- Tointroducethebasicnotionsofvectorspaceswhichwillthenbeusedtosolve related problems.
- To understand the concepts of vector space, linear transformations ,inner product spaces and orthogonalization..
- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To provide necessarybasics in probability that are relevant in applications such as random signals, linear systems in communication engineering.
- Tounderstandthebasicconceptsofprobability,oneandtwodimensionalrandom
- variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.

UNIT-I PROBABILITYANDRANDOMVARIABLES 9+3

Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous

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

UNIT-II TWO-DIMENSIONALRANDOMVARIABLES 9+3

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

UNIT–IIIRANDOMPROCESSES9+3

Classification – Stationary process – Markov process - Poisson process - Discrete parameter Markovchain–ChapmanKolmogorovequations(Statement only)-Limitingdistributions.

UNIT-IV VECTORSPACES 9+3

Vector spaces – Subspaces – Linear combinations and linear system of equations –Linear independence and linear dependence – Bases and dimensions.

UNIT-V LINEARTRANSFORMATIONANDINNERPRODUCTSPACES 9+3

Lineartransformation - Nullspacesandranges -Dimensiontheorem -Matrixrepresentation of a linear transformations - Inner product - Norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Leastsquareapproximation.

TOTAL:60PERIODS

COURSEOUTCOMES:

Uponsuccessfulcompletionofthecourse,studentswillbeableto:

CO1:Explain the fundamental concepts of advanced algebra and their rolein modern mathematics and applied contexts.

CO2:Demonstrateaccurateandefficientuseofadvancedalgebraictechniques.

CO3:Applytheconceptofrandomprocessesinengineeringdisciplines.

CO4:Understand the fundamental concepts of probability with a thorough knowledge of standarddistributions that can describe certain real-life phenomenon.

CO5:Understandthebasicconceptsofoneandtwodimensionalrandomvariablesand appl ythemtomodelengineeringproblems.

TEXTBOOKS:

1. Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., “Fundamentals ofQueueing Theory", Wiley Student 4th Edition, 2014.
2. Ibe, O.C., “Fundamentalsof Applied Probability andRandom Processes",Elsevier,1stIndian Reprint, 2007.
3. Friedberg. A.H., Insel. A.J. and Spence. L., “Linear Algebra”, Prentice Hall of India, New Delhi,4th Edition, 2004.

REFERENCES:

1. Hsu, "Schaum’sOutlineofTheoryandProblems ofProbability, RandomVariablesandRandom Processes", Tata McGraw Hill Edition, New Delhi, 2004.

2. Trivedi, K.S., "Probabilityand Statistics withReliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.
3. Yates,R.D.andGoodman.D.J.,"Probability andStochasticProcesses",2ndEdition,WileyIndia Pvt. Ltd., Bangalore, 2012.
4. Kolman.B.Hill.D.R.,"IntroductoryLinear Algebra",PearsonEducation,NewDelhi, FirstReprint, 2009.
5. Kumaresan. S., "Linear Algebra – A Geometric Approach", Prentice – Hall of India, New Delhi, Reprint, 2010.
6. Strang.G.,"LinearAlgebraanditsapplications",Thomson(Brooks/Cole),NewDelhi,2005.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	2	1	1	1	-	-	-	-	-	-	-	-	-
2	3	3	2	1	2	1	-	-	-	-	-	-	-	-	-
3	3	3	2	2	2	1	-	-	-	-	-	1	-	-	-
4	3	3	1	1	2	1	-	-	-	-	-	-	-	-	-
5	3	3	1	1	2	1	-	-	-	-	-	-	-	-	-
CO	3	3	1.6	1.2	1.8	1	-	-	-	-	-	1	-	-	-

1-low,2-medium,3-high,'-"-nocorrelation

21152S33 **CPROGRAMMINGANDDATASTRUCTURES** **L T**
30

COURSEOBJECTIVES:

- TointroducethebasicsofCprogramminglanguage.
- Tolearnthe concepts ofadvancedfeaturesofC.
- TounderstandtheconceptsofADTsandlineardatastructures.
- Toknowtheconceptsofnon-lineardatastructureandhashing.
- Tofamiliarizetheconceptsofsortingandsearchingtechniques.

UNITI CPROGRAMMINGFUNDAMENTALS(8+1SKILL) **9**

Data Types – Variables – Operations – Expressions and Statements – Conditional Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays.

UNITIICPROGRAMMING-ADVANCEDFEATURES(8+1SKILL) **9**

Structures – Union – Enumerated Data Types – Pointers: Pointers to Variables, Arrays and Functions – File Handling – Preprocessor Directives.

UNITIIILINEARDATASTRUCTURES(8+1SKILL) **9**

Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List – Doubly-Linked Lists – Circular Linked List – Stack ADT – Implementation of Stack – Applications – Queue ADT – Priority Queues –Queue Implementation– Applications.

UNITIVNON-LINEARDATASTRUCTURES (8+1 SKILL) **9**

Trees-BinaryTrees-TreeTraversals-ExpressionTrees-BinarySearchTree-Hashing-Hash Functions- Separate Chaining – Open Addressing – Linear Probing- QuadraticProbing – Double

Hashing-Rehashing.

UNITV SORTINGANDSEARCHINGTECHNIQUES(8+1SKILL) 9

InsertionSort-QuickSort-HeapSort-MergeSort-LinearSearch-BinarySearch.

TOTAL:45PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation/Quiz/SurpriseTest/SolvingGATEquestions/etc) 5

COURSEOUTCOMES:

CO1:DevelopCprogramsforanyrealworld/technicalapplication.

CO2:ApplyadvancedfeaturesofCinsolvingproblems.

CO3:Writefunctionstoimplementlinearandnon–lineardatastructureoperations.

CO4: Suggest and use appropriate linear/non–linear data structureoperations for solving agivenproblem.

CO5:Appropriatelyusesortandsearchalgorithmsforagivenapplication.

CO6:Apply appropriate hash functions that result in a collision free scenario for datastorageandretrieval.

TEXTBOOKS:

1. MarkAllenWeiss,"DataStructuresandAlgorithmAnalysisinC",SecondEdition, PearsonEducation, 1997.
2. ReemaThareja,"ProgramminginC",SecondEdition,OxfordUniversityPress,2016.

REFERENCES:

1. BrianW.Kernighan,RobPike,"ThePracticeofProgramming",PearsonEducation,1999.
2. PaulJ.Deitel,HarveyDeitel,"CHow toProgram",SeventhEdition,PearsonEducation, 2013.
3. AlfredV.Aho,JohnE.Hopcroft,JeffreyD.Ullman,"DataStructuresandAlgorithms", Pearson Education,1983.
4. Ellis Horowitz, SartajSahni and Susan Anderson, "Fundamentals of Data Structures", Galgotia, 2008.

List of Open Source Software/ Learning website:

https://www.coursera.org/specializations/data-structures-algorithms

https://nptel.ac.in/courses/112107243https://nptel.ac.in/courses/112105598

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	2	3	1	2	2	1	1	-	1	2	1	3	2	1	3
2	1	2	1	2	2	-	-	-	1	1	1	2	2	2	2
3	2	3	1	2	3	-	-	-	1	1	1	2	2	1	2
4	2	1	-	1	1	-	-	-	2	1	1	2	2	3	1
5	1	2	1	2	2	1	1	-	1	2	1	3	2	2	3
CO	2	2	1	2	2	1	1	-	1	1	1	2	2	2	2

1-low,2-medium,3-high,'-'-no correlation

21152C35 SIGNALSANDSYSTEMS LTPC

3104

COURSEOBJECTIVES:

- Tounderstandthebasicpropertiesofsignal&systems
- ToknowthemethodsofcharacterizationofLTIsystemsintimedomain
- Toanalyzecontinuoustimesignalsandsystemin theFourier andLaplace domain
- Toanalyzediscretetimesignalsandsystemin theFourier andZtransformdomain

UNIT I CLASSIFICATIONOFSIGNALSANDSYSTEMS 6+6

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant& Time-invariant,Causal & Non-causal, Stable & Unstable.

UNITIIANALYSISOFCONTINUOUSTIMESIGNALS 6+6

Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms andProperties

UNITIII LINEARTIMEINVARIANTCONTINUOUSTIMESYSTEMS 6+6

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNITIV ANALYSISOFDISCRETETIMESIGNALS 6+6

BasebandsignalSampling–FourierTransformof discretetimesignals(DTFT)–PropertiesofDTFT - ZTransform&Properties

UNIT V LINEARTIMEINVARIANT-DISCRETETIMESYSTEMS 6+6

Impulse response–Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

TOTAL:30+30PERIODS

COURSEOUTCOMES:

Attheendofthecourse,thestudentwillbeableto:

CO1:determineifagivensystemislinear/causal/stable

CO2:determinethefrequencycomponentspresentinadeterministicsignal

CO3:characterize continuous LTI systems in the time domain and frequency domainCO4:characterize discrete LTI systems in the time domain and frequency domain CO5:compute the output of an LTI system in the time and frequency domains

TEXTBOOKS:

1. Oppenheim, Willsky andHamid,"Signals andSystems",2nd Edition, Pearson Education, New Delhi, 2015.(Units I - V)
2. SimonHaykin,BarryVanVeen,"SignalsandSystems",2ndEdition,Wiley,2002

REFERENCES:

1. B.P.Lathi,"PrinciplesofLinearSystemsandSignals",2nd Edition,Oxford,2009.
2. M.J.Roberts,"SignalsandSystemsAnalysisusingTransformmethodsandMATLAB", McGraw-Hill Education, 2018.
3. JohnAlanStuller,"AnIntroductiontoSignalsandSystems",Thomson,2007.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	-	3	-	3	2	-	-	-	-	-	3	-	-	1
2	3	-	3	-	-	2	-	-	-	-	-	3	-	3	-
3	3	3	-	-	3	2	-	-	-	-	-	3	2	-	-
4	3	3	-	-	3	2	-	-	-	-	-	3	-	3	1
5	3	3	-	3	3	2	-	-	-	-	-	3	-	3	1
CO	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**3**	**1**

1-low,2-medium, 3-high,'-'-no correlation

21152C36 ELECTRONICDEVICESANDCIRCUITS LTPC 30 03

COURSEOBJECTIVES:

- To give a comprehensive exposure to all types of devices and circuits constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits
- Toanalyzethefrequencyresponseofsmallsignal amplifiers
- Todesignandanalyzesinglestageandmultistageamplifiercircuits
- Tostudyaboutfeedbackamplifiersandoscillatorsprinciples
- Tounderstandtheanalysis anddesignofmultivibrators

UNITI SEMICONDUCTORDEVICES 9

PN junction diode, Zener diode, BJT, MOSFET, UJT –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier, Zener as regulator

UNITII AMPLIFIERS 9

Load line, operating point, biasing methods for BJT and MOSFET**,** BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS, CG and Source follower – Gain and frequency response- High frequency analysis.

UNITIII MULTISTAGEAMPLIFIERSANDDIFFERENTIALAMPLIFIER 9

Cascodeamplifier,Differentialamplifier–CommonmodeandDifferencemodeanalysis–

MOSFETinputstages–tunedamplifiers–Gainandfrequencyresponse–Neutralization methods.

UNITIV FEEDBACKAMPLIFIERSANDOSCILLATORS 9

Advantages of negative feedback – Voltage / Current, Series , Shunt feedback Amplifiers–positivefeedback–Conditionforoscillations, phaseshift –Wienbridge, Hartley, Colpitts andCrystal oscillators.

UNITV POWERAMPLIFIERSANDDC/DCCONVERTERS 9

Power amplifiers- class A-Class B-Class AB-Class C-Power MOSFET-Temperature Effect-ClassABPoweramplifierusingMOSFET–DC/DCconvertors–Buck,Boost, Buck-Boost analysis and design.

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecoursethestudentswillbeableto

CO1:Explainthestructureandworkingoperationofbasicelectronicdevices.

CO2:Designandanalyzeamplifiers.

CO3: Analyze frequency response of BJT and MOSFET amplifiers **CO4**: Design and analyze feedback amplifiers and oscillatorprinciples.**CO5**:Designandanalyzepoweramplifiers and supply circuits

TEXTBOOKS :

1. David A. Bell, "Electronic Devices and Circuits", Oxford Higher Educationpress, 5th Edition,2010.
2. RobertL.BoylestadandLouisNasheresky,"ElectronicDevicesandCircuitTheory", 10thEdition, Pearson Education / PHI, 2008.
3. Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", Oxford University Press, 7 thEdition, 2014.REFERENCES :
    1. Donald.A. Neamen, "Electronic Circuit AnalysisandDesign", TataMcGraw Hill, 3rd Edition, 2010.
    2. D.SchillingandC.Belove,"ElectronicCircuits",McGrawHill,3rdEdition,1989
    3. MuhammadH.Rashid,"PowerElectronics",PearsonEducation/PHI,2004.

CO's-PO's&PSO'sMAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	3	3	3	3	2	1	-	-	-	-	-	1	2	1	1
2	3	2	2	3	2	2	-	-	-	-	-	1	2	1	1
3	3	3	3	2	1	2	-	-	-	-	-	1	2	1	1
4	3	3	2	3	2	2	-	-	-	-	-	1	2	1	1
5	3	2	3	2	2	1	-	-	-	-	-	1	2	1	1
CO	**3**	**3**	**3**	**3**	**2**	**2**	-	-	-	-	-	**1**	**2**	**1**	**1**

1-low,2-medium, 3-high,'-'-nocorrelation

221152S32	**CONTROLSYSTEMS**	**L**	**TPC**
		3	**003**

COURSEOBJECTIVES:

- Tointroducethe componentsandtheirrepresentationofcontrolsystems
- Tolearnvariousmethods foranalyzingthetimeresponse, frequencyresponseandstabilityof the systems.
- Tolearnthevariousapproachforthestatevariableanalysis.

UNIT I SYSTEMSCOMPONENTSANDTHEIRREPRESENTATION 9

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory- Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

UNITII TIMERESPONSEANALYSIS 9

Transient response-steadystate response-Measuresof performanceof thestandard first order and second order system-effect on an additional zero and an additional pole-steady errorconstantandsystem-typenumber-PID control-AnalyticaldesignforPD,PI,PIDcontrol systems

UNITIII FREQUENCYRESPONSEANDSYSTEMANALYSIS 9

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

UNITIV CONCEPTSOFSTABILITY ANALYSIS 9

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

UNIT V CONTROLSYSTEMANALYSISUSINGSTATEVARIABLEMETHODS 9

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

TOTAL:45 PERIODS

COURSEOUTCOMES:

Uponsuccessfulcompletionofthecoursethe studentwillbeabletoCO1: Compute the transfer function of different physical systems.

CO2:Analysethetimedomainspecificationandcalculatethesteadystateerror.

CO3:Illustratethefrequency responsecharacteristicsofopenloopandclosedloopsystem

response.

CO4:AnalysethestabilityusingRouthandrootlocustechniques.

CO5: Illustrate the state space model of a physical system and discuss the concepts ofsampleddata control system.

TEXTBOOK:

1. M.Gopal,"ControlSystem–PrinciplesandDesign",TataMcGrawHill,4th Edition,2012.

REFERENCE:

1. J.NagrathandM.Gopal,"ControlSystemEngineering",NewAgeInternationalPublishers, 5th Edition, 2007.
2. K.Ogata,"ModernControlEngineering",PHI,5th Edition,2012.
3. S.K.Bhattacharya,"ControlSystemEngineering",Pearson,3rd Edition, 2013.
4. Benjamin.C.Kuo,"AutomaticControlSystems",PrenticeHallofIndia,7th Edition,1995.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	3	2	2	2	-	-	-	-	2	3	3	3	3
2	3	3	3	3	2	3	-	-	-	-	2	2	3	3	3
3	3	2	3	3	2	2	-	-	-	-	2	3	3	2	3
4	3	3	3	2	2	2	-	-	-	-	2	2	3	3	3
5	2	2	3	3	2	3	-	-	-	-	2	3	2	2	3
CO	3	3	3	3	2	2	-	-	-	-	2	3	3	3	3

1-low,2-medium,3-high,'-'-no correlation

21152C34 DIGITALSYSTEMSDESIGN LTPC 3024

COURSEOBJECTIVES:

- Topresentthefundamentalsofdigitalcircuitsand simplificationmethods
- Topracticethedesignofvariouscombinationaldigitalcircuitsusinglogicgates
- To bring out the analysis and design procedures for synchronous and asynchronous Sequential circuits
- Tolearnintegratedcircuitfamilies.
- Tointroducesemiconductormemoriesandrelatedtechnology

UNIT I BASICCONCEPTS 9

Review of number systems-representation-conversions, Review of Boolean algebra-theorems, sum of product and product of sum simplification, canonical forms min term and max term, Simplification of Boolean expressions-Karnaugh map, completely and incompletely specified functions, Implementation of Boolean expressions using universal gates ,Tabulation methods.

UNITIICOMBINATIONALLOGICCIRCUITS **9**

Problemformulationanddesignofcombinationalcircuits-Code-Converters,HalfandFull

Adders, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/Demux, Case study: Digital trans-receiver / 8 bit Arithmetic and logic unit, Parity Generator/Checker, Seven Segment display decoder

UNITIII SYNCHRONOUSSEQUENTIALCIRCUITS 9

Latches, Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment,lock - out condition circuit implementation - Counters, Ripple Counters, Ring Counters, Shift registers, Universal Shift Register. Model Development: Designingof rolling display/real time clock

UNITIV ASYNCHRONOUSSEQUENTIALCIRCUITS 9

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Fundamental and Pulse mode sequential circuits, Design of Hazard free circuits.

UNIT V LOGICFAMILIESANDPROGRAMMABLELOGICDEVICES 9

Logicfamilies-PropagationDelay, Fan-InandFan-Out-NoiseMargin-RTL ,TTL,ECL, CMOS - Comparison of Logic families - Implementation of combinational logic/sequential logic design using standard ICs, PROM, PLA and PAL, basicmemory, static ROM,PROM,EPROM,EEPROM EAPROM.

45PERIODS

PRACTICALEXERCISES: 30PERIODS

1. Designofaddersand subtractors&codeconverters.
2. DesignofMultiplexers&Demultiplexers.
3. DesignofEncodersandDecoders.
4. DesignofMagnitudeComparators
5. Designandimplementationofcountersusing flip-flops
6. Designandimplementationofshift registers.

COURSEOUTCOMES:

Attheendofthecoursethestudentswillbeableto

CO1:UseBooleanalgebraandsimplificationproceduresrelevanttodigitallogic.
CO2:Designvariouscombinationaldigitalcircuitsusinglogicgates.
CO3:Analyse and design synchronous sequential circuits. **CO4**: Analyse and design asynchronous sequentialcircuits..**CO5**:Buildlogicgatesanduse programmable devices

TOTAL:75 PERIODS

TEXTBOOKS:

1. M.MorrisManoandMichaelD.Ciletti,'Digital Design',Pearson,5thEdition,2013.(Unit-I-V)

REFERENCES:

1. CharlesH.Roth,Jr,'FundamentalsofLogicDesign',JaicoBooks,4thEdition,2002.
2. WilliamI.Fletcher,"AnEngineeringApproachtoDigitalDesign",Prentice-Hall of India,1980.
3. FloydT.L.,"DigitalFundamentals",CharlesE.Merrilpublishingcompany,1982.
4. John. F.Wakerly, "DigitalDesignPrinciplesand Practices", PearsonEducation, 4th Edition,2007.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	1	1	1	-	-	-	-	-	-	-	-	-
2	3	3	2	1	2	1	-	-	-	-	-	-	-	-	-
3	3	3	2	2	2	1	-	-	-	-	-	1	-	-	-
4	3	3	1	1	2	1	-	-	-	-	-	-	-	-	-
5	3	3	1	1	2	1	-	-	-	-	-	-	-	-	-
CO	3	3	1.6	1.2	1.8	1	-	-	-	-	-	1	-	-	-

1-low,2-medium,3-high,'-'-no correlation

21152L38 ELECTRONICDEVICESAND CIRCUITSLABORATORY LTPC

00 31.5

COURSEOBJECTIVES

- TolearnthecharacteristicsofPNJunctiondiodeandZenerdiode.
- Tounderstandtheoperationofrectifiersandfilters.
- Tostudythecharacteristics ofamplifier.

LISTOFEXPERIMENTS

1. CharacteristicsofPNJunctionDiodeandZenerdiode.
2. FullWaveRectifierwithFilters.
3. DesignofZener diodeRegulator.
4. CommonEmitterinput-outputCharacteristics.
5. MOSFETDraincurrentandTransferCharacteristics.
6. FrequencyresponseofCEandCS amplifiers.
7. FrequencyresponseofCBandCCamplifiers.
8. FrequencyresponseofCascodeAmplifier
9. CMRRmeasurementofDifferentialAmplifier
10. ClassATransformerCoupledPowerAmplifier.

COURSEOUTCOMES

Attheendofthelaboratorycourse,thestudentwillbeabletounderstandthe

CO1: Characteristics of PN Junction Diode and Zener diode.

CO2: DesignandTestingofBJTandMOSFETamplifiers.

CO3: Operationofpoweramplifiers.

TOTAL:45 PERIODS

REFERENCE:

XYZofOscilloscope–Applicationnote:TektronixUSA.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	2	2	3	3	2	1	-	-	-	-	-	1	2	1	1
2	2	2	3	3	2	1	-	-	-	-	-	1	2	1	1
3	2		2		1	1	-	-	-	-	-	1	2	1	1
4	-	-	-	-	3	1	-	-	-	-	-	1	2	1	1
5	-	-	-	-	2	1	-	-	-	-	-	1	2	1	1
CO	**2**	**2**	2.	**3**	**2**	**1**	-	-	-	-	-	**1**	**2**	**1**	**1**

1-low,2-medium,3-high,'-'-no correlation

2L37 **PROGRAMMINGANDDATASTRUCTURESLABORATORY** **LTP**

0035

COURSEOBJECTIVES:

- Todevelop applicationsinC
- Toimplementlinearandnon-lineardatastructures
- Tounderstandthedifferentoperationsofsearchtrees
- Togetfamiliarizedtosortingandsearchingalgorithms

LISTOFEXPERIMENTS

1. PracticeofCprogrammingusingstatements,expressions,decisionmakinganditerative statements
2. PracticeofCprogrammingusingFunctionsandArrays
3. ImplementCprogramsusingPointersandStructures
4. ImplementCprogramsusingFiles
5. Developmentofrealtime Capplications
6. ArrayimplementationofListADT
7. ArrayimplementationofStack andQueueADTs
8. LinkedlistimplementationofList,StackandQueueADTs
9. ApplicationsofList,StackandQueue ADTs
10. 10.ImplementationofBinaryTrees andoperations ofBinaryTrees
11. Implementation ofBinarySearchTrees
12. Implementationofsearchingtechniques
13. ImplementationofSortingalgorithms:InsertionSort,QuickSort,MergeSort
14. ImplementationofHashing–anytwocollision techniques

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecourse,thestudentswillbeableto:

CO1:UsedifferentconstructsofCanddevelopapplications

CO2:Writefunctionstoimplementlinearandnon-lineardatastructureoperations

CO3:Suggestandusetheappropriatelinear/non-lineardatastructureoperationsfora givenproblem

CO4:Applyappropriatehashfunctionsthatresultinacollisionfreescenariofordata

storage andRetrieval

CO5:ImplementSortingandsearchingalgorithmsforagivenapplication

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	2	3	1	2	2	1	1	-	1	2	1	3	2	1	3
2	1	2	1	2	2	-	-	-	1	1	1	2	2	2	2
3	2	3	1	2	3	-	-	-	1	1	1	2	2	1	2
4	2	1	-	1	1	-	-	-	2	1	1	2	2	3	1
5	1	2	1	2	2	1	1	-	1	2	1	3	2	2	3
CO	2	2	1	2	2	1	1	-	1	1	1	2	2	2	2

1-low,2-medium,3-high,'-'-no correlation

21152L39 PROFESSIONALDEVELOPMENT LTPC
0021

COURSEOBJECTIVES:

TobeproficientinimportantMicrosoftOfficetools:MSWORD,EXCEL,POWERPOINT.

- To be proficient in using MS WORD to create quality technical documents,byusingstandard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize,interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MSWORD: 10Hours

Create and format a

documentWorkingwith

tables

WorkingwithBulletsandLists

Workingwithstyles,shapes,smartart,charts

Insertingobjects,chartsandimportingobjectsfromother office toolsCreating

and Using document templates

Insertingequations,symbolsandspecialcharacters

WorkingwithTableofcontentsandReferences,

citationsInsert and review comments

Createbookmarks,hyperlinks,endnotes

footnoteViewing document in different

modes

Working with document protection and

securityInspectdocumentforaccessibility

MSEXCEL: 10Hours

Createworksheets,insertandformatdata

Workwithdifferenttypesofdata:text,currency,date,

numeric etc.Split, validate, consolidate, Convert data

Sort and filter data

Performcalculationsandusefunctions:(Statistical,Logical,Mathematical,date,

Timeetc.,)WorkwithLookupandreferenceformulae

Create and Work with different types of

chartsUsepivottablestosummarizeand

analyse data

Performdataanalysisusingownformulaeandfunctions

Combinedatafrommultipleworksheetsusingownformulaeandbuilt-infunctionsto generateresults

Exportdataandsheetstootherfile

formatsWorking with macros

ProtectingdataandSecuringtheworkbook

MSPOWERPOINT: 10Hours

Select slide templates, layout and themes

Formattingslidecontentandusingbulletsand

numberingInsertandformatimages,smartart,tables,

charts

UsingSlide master,notesandhandout

masterWorking with animation and

transitionsOrganizeandGroupslides

Importorcreateandusemediaobjects:audio,video,animation

PerformslideshowrecordingandRecordnarrationandcreatepresentablevideos

TOTAL:30PERIODS

COURSEOUTCOMES:

Onsuccessfulcompletionthestudentswillbeableto

CO1:Use MSWord to create qualitydocuments, by structuring and organizing content for their dayto day technical and academic requirements

CO2:Use MSEXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding

CO3:UseMSPowerPointtocreatehighqualityacademicpresentationsbyincluding commontables, charts, graphs, interlinking other elements, and using media objects.

21152C41 ELECTROMAGNETICFIELDS LTPC 3003

COURSEOBJECTIVES:

- Toimpartknowledgeonthebasicsofstaticelectricfieldandtheassociatedlaws
- Toimpartknowledgeonthebasicsofstaticmagneticfieldand theassociatedlaws
- Togive insight into couplingbetweenelectricandmagneticfieldsthroughFaraday's law, displacement current and Maxwell's equations
- TogainthebehaviouroftheпropagationofEMwaves
- TostudythesignificanceofTimevaryingfields.

UNIT I INTRODUCTION 9

Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical andspherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem, Verify theorems for different path, surface and volume.

UNITII ELECTROSTATICS 9

Electric field, Coulomb's law, Gauss's law and applications, Electric potential,Conductorsin static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Electrostatics boundary value problems, Capacitance, Parallel, cylindrical and spherical capacitors, Electrostatic energy, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law, Electromotive force and Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law

UNITIII MAGNETOSTATICS 9

Lorentz force equation, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Calculation of

magnetic field intensity for various current distributions Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy, Magnetic forces and torques

UNITIVTIME-VARYINGFIELDSANDMAXWELL'sEQUATIONS 9

Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields, Observing the Phenomenon of wave propagation with the aid of Maxwell's equations

UNITVPLANEELECTROMAGNETIC WAVES 9

Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary

COURSEOUTCOMES:

Attheendofthecoursethestudentswillbeableto

CO1:Relatethefundamentalsofvector,coordinatesystemtoelectromagneticconcepts

CO2:AnalyzethecharacteristicsofElectrostaticfield

CO3:InterprettheconceptsofElectricfieldinmaterialspace andsolvetheboundary conditions**CO4**: Explain the concepts and characteristics of Magneto Static field in material space and solve boundary conditions.

CO5:Determinethesignificanceoftimevaryingfields

TOTAL:45 PERIODS

TEXTBOOKS

1. D.K.Cheng,Fieldandwaveelectromagnetics,2nded.,Pearson(India), 2002
2. M.N.O.Sadiku and S.V. Kulkarni, Principles ofelectromagnetics, 6thed., Oxford(Asian Edition), 2015

REFERENCES

1. EdwardC.Jordan &KeithG.Balmain,ElectromagneticwavesandRadiatingSystems, Second Edition, Prentice-Hall Electrical Engineering Series, 2012.
2. W.H.HaytandJ.A.Buck,Engineeringelectromagnetics,7thed.,McGraw-Hill(India),2006
3. B.M.Notaros,Electromagnetics,Pearson:NewJersey,2011

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	2	1	1	1	-	2	1	-	-	1	-	2	-	-	-
2	2	2	3	3	2	2	2	-	-	1	1	2	-	-	-
3	2	2	3	2	2	2	1	-	-	1	1	2	-	-	-
4	2	2	3	2	2	2	1	-	-	1	1	2	-	-	-
5	2	2	2	2	2	2	1	-	-	2	2	1	-	-	-
CO	**2**	**2**	**2**	**2**	**2**	**2**	**1**	-	-	**1**	**1**	**2**	-	-	-

1-low,2-medium,3-high,'-'-no correlation

21152C45 NETWORKSANDSECURITY LTPC

3024

COURSEOBJECTIVES:

- TolearntheNetworkModelsanddatalink layerfunctions.
- TounderstandroutingintheNetworkLayer.
- ToexploremethodsofcommunicationandcongestioncontrolbytheTransportLayer.
- TostudytheNetworkSecurityMechanisms.
- Tolearnvarioushardwaresecurityattacksandtheir countermeasures**.**

UNITI NETWORKMODELSANDDATALINKLAYER 9

Overview of Networks and its Attributes – Network Models – OSI, TCP/IP, Addressing – Introductionto Datalink Layer – Error Detection and Correction – Ethernet(802.3)- Wireless LAN – IEEE 802.11, Bluetooth– Flow and Error Control Protocols – HDLC – PPP.

UNITII NETWORKLAYERPROTOCOLS 9

Network Layer – IPv4 Addressing – Network Layer Protocols(IP,ICMP and Mobile IP) Unicast and Multicast Routing – Intradomain and Interdomain Routing Protocols – IPv6

Addresses – IPv6 – Datagram Format - Transition from IPv4 to IPv6.

UNITIII TRANSPORTANDAPPLICATIONLAYERS 9

TransportLayerProtocols–UDPandTCPConnectionandStateTransitionDiagram-

Congestion Control and Avoidance(DEC bit, RED)- QoS - Application Layer Paradigms – Client–ServerProgramming–DomainNameSystem–World WideWeb,HTTP,Electronic Mail.

UNITIV NETWORKSECURITY 9

OSI Security Architecture – Attacks – Security Services and Mechanisms – Encryption – Advanced Encryption Standard – Public Key Cryptosystems – RSA Algorithm – Hash Functions–SecureHash Algorithm – Digital Signature Algorithm.

UNITV HARDWARESECURITY 9

Introductiontohardwaresecurity,HardwareTrojans,Side–ChannelAttacks–Physical AttacksandCountermeasures–DesignforSecurity.IntroductiontoBlockchainTechnology.

45PERIODS

PRACTICALEXERCISES: 30PERIODS

ExperimentsusingC

1. ImplementtheDataLinkLayerframingmethods,
   i) Bitstuffing,(ii)Characterstuffing
2. ImplementationofErrorDetection/CorrectionTechniques
   i) LRC,(ii)CRC,(iii)Hammingcode
3. ImplementationofStopandWait,andSlidingWindowProtocols
4. ImplementationofGoback-NandSelectiveRepeatProtocols.
5. ImplementationofDistanceVectorRoutingalgorithm(RoutingInformation Protocol)(Bellman-Ford).
6. ImplementationofLinkStateRoutingalgorithm(OpenShortestPathFirst)with5 nodes(Dijkstra's).
7. DataencryptionanddecryptionusingDataEncryptionStandardalgorithm.
8. DataencryptionanddecryptionusingRSA(Rivest,ShamirandAdleman) algorithm.
9. ImplementClient ServermodelusingFTPprotocol.

ExperimentsusingTool CommandLanguage

1. ImplementandrealizetheNetworkTopology-Star,BusandRingusingNS2.
2. Implementand performtheoperationofCSMA/CDandCSMA/CAusingNS2.

COURSEOUTCOMES:

UponsuccessfulcompletionofthecoursethestudentwillbeabletoCO1: Explain the Network Models, layers and functions.

CO2:Categorizeandclassifytheroutingprotocols.

CO3: List the functions of the transport and application layer.

CO4: Evaluate and choose the network security mechanisms.

CO5:Discussthehardwaresecurityattacksandcountermeasures.

TOTAL:75 PERIODS

TEXTBOOKS

1. Behrouz.A.Forouzan,DataCommunicationandNetworking,FifthEdition,TMH,2017.(Unit –I,II,III)
2. WilliamStallings,CryptographyandNetworkSecurity,SeventhEdition,Pearson

Education,2017(Unit-IV)
3. BhuniaSwarup,HardwareSecurity–AHandsOnApproach,MorganKaufmann,First edition,2018.(Unit – V).

REFERENCES

1. James.F.Kuroseand Keith.W.Ross, Computer Networking –ATop –DownApproach, SixthEdition, Pearson, 2017.
2. Doughlas.E.Comer,ComputerNetworksandInternetswithInternetApplications,Fourth Edition, Pearson Education, 2008.

21152C42 LINEARINTEGRATEDCIRCUITS LTPC

3003

COURSEOBJECTIVES:

- Tointroducethebasicbuildingblocksoflinearintegratedcircuits
- Tolearnthelinearandnon-linearapplications ofoperationalamplifiers
- Tointroducethetheoryand applications ofanalog multipliersandPLL
- TolearnthetheoryofADC andDAC
- Tointroducetheconceptsofwaveformgenerationandintroducesomespecialfunction ICs

UNIT I BASICSOFOPERATIONALAMPLIFIERS 9

Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations – MOSFET Operational Amplifiers – LF155 and TL082.

UNITII APPLICATIONSOFOPERATIONALAMPLIFIERS 9

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass andband-pass Butterworth filters.

UNITIII ANALOGMULTIPLIERANDPLL 9

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronization

UNITIV ANALOGTODIGITALANDDIGITALTOANALOGCONVERTERS 9

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2RLadder type, Voltage Mode and Current-Mode *R - 2R* Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications -

Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters, Sigma – Delta converters.

UNIT V WAVEFORMGENERATORSANDSPECIALFUNCTIONICS 9

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Low Drop – Out(LDO) Regulators - Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC

COURSEOUTCOMES:

Attheendofthecoursethestudentswillbeableto

CO1 : Design linear and nonlinear applications of OP – AMPS**CO2**:Designapplicationsusinganalogmultiplier and PLL **CO3** : Design ADC and DAC using OP – AMPS

CO4:GeneratewaveformsusingOP–AMPCircuits

CO5:AnalyzespecialfunctionICs

TEXTBOOK

TOTAL:45 PERIODS

1. 1.D.RoyChoudhry, ShailJain, "Linear Integrated Circuits", NewAgeInternationalPvt. Ltd.,2018, Fifth Edition. (Unit I – V)
2. 2.Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4thEdition, Tata Mc Graw-Hill, 2016 (Unit I – V)

REFERENCES

1. RamakantA.Gayakwad,"OP-AMPandLinearICs",4thEdition,PrenticeHall / PearsonEducation, 2015
2. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2001.
3. S.Salivahanan&V.S.KanchanaBhaskaran,"LinearIntegratedCircuits",TMH,2nd Edition, 4th Reprint, 2016.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	-	-	-	-	-	-	-	-	-	1	-	2	1	1
2	2	3	3	2	-	-	-	-	-	-	-	-	2	1	1
3	1	-	-	2	-		-	-	-	-	-	-	2	1	1
4	1	-	-	2	-	-	-	-	-	-	-	-	2	1	1
5	1	2	3	3	-	-	-	-	-	-	-	3	2	1	1
CO	**.4**	**.5**	**3**	**.2**	-	-	-	-	-	-	**1**	**3**	**2**	**1**	**1**

1-low,2-medium,3-high,'-'-no correlation

21152C44 DIGITALSIGNALPROCESSING L C
3 4

COURSEOBJECTIVES:

- Tolearndiscretefouriertransform,propertiesofDFTanditsapplicationtolinear filtering
- Tounderstand the characteristics ofdigitalfilters, designdigital IIR and FIR filtersand applythese filters to filter undesirable signals in various frequency bands
- Tounderstand theeffectsoffiniteprecisionrepresentationondigitalfilters
- Tounderstandthefundamentalconceptsofmultiratesignalprocessingandits applications
- **T**ointroducetheconceptsofadaptivefiltersanditsapplicationtocommunication engineering

UNITI DISCRETEFOURIERTRANSFORM 9

Sampling Theorem, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT). Linear filtering using FFT.

UNITII INFINITEIMPULSERESPONSEFILTERS 9

Characteristics of practical frequency selective filters. characteristics of commonly used analogfilters - Butterworth filters, Chebyshev filters. Design of IIR filters fromanalogfilters

(LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency

transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

UNITIII FINITEIMPULSERESPONSEFILTERS 9

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

UNITIV FINITEWORDLENGTHEFFECTS 9

Fixedpointandfloatingpoint numberrepresentation-ADC-quantization-truncationand rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNITV DSPAPPLICATIONS 9

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion bya rationalfactor – Adaptive Filters: Introduction,Applicationsof adaptive filtering to equalization-DSP Architecture-Fixed and Floating point architecture principles

45PERIODS

PRACTICALEXERCISES: 30PERIODS

MATLAB/EQUIVALENTSOFTWAREPACKAGE/DSP PROCESSOR BASEDIMPLEMENTATION

1. GenerationofelementaryDiscrete-Time sequences
2. LinearandCircularconvolutions
3. AutocorrelationandCrossCorrelation
4. FrequencyAnalysisusingDFT
5. DesignofFIRfilters(LPF/HPF/BPF/BSF)anddemonstratesthefilteringoperation
6. DesignofButterworthandChebyshevIIRfilters(LPF/HPF/BPF/BSF)anddemonstratethe filtering operations
7. StudyofarchitectureofDigitalSignalProcessor
8. PerformMACoperationusingvariousaddressingmodes
9. Generationofvarioussignalsandrandomnoise
10. DesignanddemonstrationofFIRFilterforLowpass,Highpass,BandpassandBand stop filtering
11. DesignanddemonstrationofButterworthandChebyshevIIRFiltersforLowpass, High pass, Band pass and Band stop filtering
12. ImplementanUp-samplingandDown-samplingoperationinDSPProcessor

COURSEOUTCOMES:

Attheendofthecoursestudentswillbeableto:

CO1: ApplyDFTfortheanalysisofdigitalsignalsandsystems
CO2: DesignIIRandFIRfilters
CO3: Characterizetheeffectsoffiniteprecisionrepresentationondigitalfilters
CO4: Designmultiratefilters
CO5: Applyadaptivefiltersappropriatelyincommunicationsystems

TOTAL:75 PERIODS

TEXTBOOKS:

1. 1.John G. Proakis and Dimitris G.Manolakis, Digital Signal Processing – Principles, AlgorithmsandApplications,FourthEdition,PearsonEducation/PrenticeHall,2007.
2. 2.A. V. Oppenheim, R.W. Schafer and J.R. Buck, ―Discrete-Time SignalProcessing", 8thIndian Reprint, Pearson, 2004.

REFERENCES

1. EmmanuelC.Ifeachor&Barrie.W.Jervis,"DigitalSignalProcessing",SecondEdition, Pearson Education / Prentice Hall, 2002.
2. 2.Sanjit K. Mitra, "DigitalSignalProcessing – A Computer Based Approach", Tata Mc GrawHill, 2007.
3. 3.AndreasAntoniou,"DigitalSignalProcessing",TataMcGrawHill,2006.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	3	3	2	2	-	-	-	-	1	1	3	3	2
2	3	3	3	3	2	2	-	-	-	-	1	1	2	2	2
3	3	3	**2**	2	2	2	-	-	-	-	1	1	1	2	2
4	3	3	2	2	3	1	-	-	-	-	1	1	2	2	3
5	3	2	2	2	3	2	-	-	-	-	1	1	2	2	1
CO	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**2**	**2**

1-low,2-medium,3-high,'-'-nocorrelation

21152C43 COMMUNICATIONSYSTEMS LTPC

3003

COURSEOBJECTIVES:

- TointroduceAnalogModulationSchemes
- Toimpartknowledgeinrandomprocess
- TostudyvariousDigitaltechniques
- Tointroducethe importanceofsampling&quantization
- Toimpartknowledgeindemodulationtechniques
- Toenhancetheclassroomteachingusingsmartconnectivityinstruments

UNITI AMPLITUDEMODULATION 9

Review of signals and systems, Time and Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals. SSB Generation – Filter and Phase Shift Methods, VSB Generation– Filter Method, Hilbert Transform, Pre-envelope & complex envelope AM techniques, Superheterodyne Receiver.

UNITII RANDOMPROCESS&SAMPLING 9

Review of probabilityand randomprocess.Gaussian andwhite noise characteristics,Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De- emphasis, Threshold effect in angle modulation.

ow pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Nyquist criterion- Logarithmic Companding –PAM, PPM, PWM, PCM – TDM, FDM

UNITIII DIGITALTECHNIQUES 9

Pulse modulationDifferentialpulsecode modulation.Delta modulation,Noiseconsiderations in PCM,, Digital Multiplexers, Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder

UNITIV DIGITALMODULATIONSCHEME 9

Geometric Representation of signals - Generation, detection, IQ representation, PSD & BER of Coherent BPSK, BFSK, & QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers Synchronization and Carrier Recovery for Digital modulation, Spectrum Analysis – Occupied bandwidth – Adjacent channel power, EVM, Principle of DPSK

UNITV DEMODULATIONTECHNIQUES 9

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference, Optimum demodulation of digital signals overband-limited channels.

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecoursestudentswillbeableto

CO1: Gainknowledgeinamplitudemodulationtechniques

CO2: UnderstandtheconceptsofRandomProcesstothedesignofcommunicationsystems

CO3: Gainknowledgeindigitaltechniques

CO4: Gainknowledgeinsamplingandquantization

CO5: Understandtheimportanceofdemodulationtechniques

TEXTBOOKS:

1. SimonHaykins,"CommunicationSystems",Wiley,5thEdition,2009.(UnitI-V)
2. B.P.Lathi, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press, 2011.

REFERENCES:

1. WaynerTomasi,ElectronicCommunicationSystem,5thEdition,PearsonEducation,2008.
2. D.Roody,J.Coolen,ElectronicCommunications,4theditionPHI2006
3. A.Papoulis,"Probability,RandomvariablesandStochasticProcesses",McGrawHill,3rd edition, 1991.
4. B.Sklar,"DigitalCommunicationsFundamentalsandApplications",2ndEditionPearson Education 2007
5. HPHsu,SchaumOutlineSeries-"AnalogandDigitalCommunications"TMH2006
6. Couch.L.,"ModernCommunicationSystems",Pearson,2001

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	3	3	2	1	1	-	-	-	1	1	-	-	-
2	3	3	3	3	2	1	1	-	-	-	1	1	-	-	-
3	3	3	3	3	3	1	1	-	-	-	1	1	-	-	-
4	3	3	3	3	3	1	1	-	-	-	1	1	-	-	-
5	3		3	3	2	1	1	-	-			1	-	-	-
CO	3		3	3	2.5	1	1	-	-			1	-	-	-

1-low,2-medium,3-high,'-'-no correlation

21149S46 ENVIRONMENTALSCIENCESANDSUSTAINABILITY LTPC
200 2

COURSEOBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept ofcarbon credit and the challenges ofenvironmental management.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energycycles and analyze the role of sustainable urbanization.

UNITI ENVIRONMENTANDBIODIVERSITY 6

Definition, scope and importance of environment– need for public awareness.Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threatsto biodiversity: habitat loss, poachingof wildlife, man-wildlife conflicts – endangeredandendemicspecies ofIndia–conservationofbiodiversity: In-situandex-situ.

UNITII ENVIRONMENTALPOLLUTION 6

Causes,Effectsand Preventive measures of Water, Soil, Air and Noise Pollutions.Solid,Hazardousand E-Waste management. Case studies onOccupationalHealth and Safety Management system (OHASMS). Environmental protection, Environmental protectionacts .

UNITIII RENEWABLESOURCESOFENERGY 6

Energymanagement and conservation, New EnergySources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNITIV SUSTAINABILITYANDMANAGEMENT 6

Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols- Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNITV SUSTAINABILITYPRACTICES 6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles- carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio- economical and technological change.

TOTAL:30 PERIODS

COURSEOUTCOMES:

CO1:To recognize and understand the functions of environment, ecosystems and biodiversity andtheir conservation.

CO2:To identify the causes, effects of environmental pollution and natural disasters and contributeto the preventive measures in the society.

CO3:Toidentifyandapplytheunderstandingof renewableandnon-renewableresourcesand contribute to the sustainable measures to preserve them for future generations.

CO4:Torecognizethedifferentgoalsofsustainabledevelopmentandapplythemfor suitabletechnological advancement and societal development.

CO5:To demonstrate the knowledge of sustainabilitypractices and identifygreen materials, energycycles and the role of sustainable urbanization.

TEXTBOOKS :

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition,New Age International Publishers ,2018.
2. BennyJoseph,'EnvironmentalScienceandEngineering',TataMcGraw-Hill,NewDelhi, 2016.
3. GilbertM.Masters,'IntroductiontoEnvironmentalEngineeringandScience',2nd

edition,PearsonEducation,2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering:Concepts,Design and CaseStudies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact AssessmentGuidelines,NotificationofGovernmentofIndia,2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . edition 2010.
2. Cunningham,W.P.Cooper,T.H.Gorhani,'EnvironmentalEncyclopedia',JaicoPubl., House,Mumbai, 2001.
3. Dharmendra S.Sengar, 'Environmental law',Prentice hall of India PVT.LTD, New Delhi,2007.
4. Rajagopalan,R,'EnvironmentalStudies-FromCrisistoCure',OxfordUniversityPress, ThirdEdition, 2015.
5. ErachBharucha"Textbook of Environmental StudiesforUndergraduate Courses"Orient Blackswan Pvt. Ltd. 2013.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	2	1	-	-	-	2	3	-	-	-	-	2	-	-	-
2	3	2	-	-	-	3	3	-	-	-	-	2	-	-	-
3	3	-	1	-	-	2	2	-	-	-	-	2	-	-	-
4	3	2	1	1	-	2	2	-	-	-	-	2	-	-	-
5	3	2	1	-	-	2	2	-	-	-	-	1	-	-	-
CO	.8	.8	1	1	-	2.2 2.	4	-	-	-	-	1.8	-	-	-

1-low,2-medium,3-high,'-'-no correlation

21152L48 COMMUNICATIONSYSTEMSLABORATORY LTPC

0031.5

COURSEOBJECTIVES:

- TostudytheAM&FMModulationandDemodulation.
- TolearnandrealizetheeffectsofsamplingandTDM.
- TounderstandthePCM&DigitalModulation.
- ToSimulateDigitalModulationSchemes.
- ToImplementEqualizationAlgorithmsandErrorControlCodingSchemes.

LISTOFEXPERIMENTS

1. AM-ModulatorandDemodulator

2. FM-ModulatorandDemodulator
3. Pre-EmphasisandDe-Emphasis.
4. SignalsamplingandTDM.
5. PulseCodeModulationandDemodulation.

6. PulseAmplitudeModulationandDemodulation.
7. PulsePositionModulationandDemodulationandPulseWidthModulationandDemodulation.
8. DigitalModulation–ASK,PSK,FSK.
9. DeltaModulationandDemodulation.
10. SimulationofASK,FSK,andBPSKGenerationandDetectionSchemes.
11. SimulationofDPSK,QPSKandQAMGenerationandDetectionSchemes.
12. SimulationofLinearBlockandCyclicErrorControlcodingSchemes.

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthelaboratorycourse,thestudentwillbeabletounderstandthe:

CO1:Design AM, FM & Digital Modulators for specific applications.

CO2:Computethesamplingfrequencyfordigitalmodulation**.**

CO3:Simulate&validatethevariousfunctionalmodulesof Communication system.**CO4**:Demonstrate their knowledge in base band signaling schemes through implementation of digital modulation schemes.

CO5:Applyvarious channel coding schemes & demonstrate their capabilities towardstheimprovementofthenoiseperformanceofCommunicationsystem.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	3	3	3	3	-	-	-	1	1	1	-	-	-
2	3	3	3	3	3	2	-	-	-	1	1	1	-	-	-
3	3	3	3	3	3	2	-	-	-	1	1	1	-	-	-
4	3	3	3	3	3	3	-	-	-	1	1	1	-	-	-
5	3	3	3	3	3	2	-	-	-	1	1	1	-	-	-
Avg	3	3	3	3	3	2.5	-	-	-	1	1	1	-	-	-

1-low,2-medium,3-high,'-'-no correlation

21152L47LINEARINTEGRATEDCIRCUITSLABORATORY **LTPC 003 1.5**

COURSEOBJECTIVES:

- Togainhandsonexperienceindesigningelectronic circuits
- Tolearnsimulationsoftwareusedincircuitdesign
- Tolearnthefundamentalprinciplesofamplifiercircuits
- Todifferentiatefeedbackamplifiersandoscillators.
- Todifferentiatetheoperationofvariousmultivibrators

LISTOFEXPERIMENTS:

DESIGNANDANALYSISOFTHEFOLLOWINGCIRCUITS

1. SeriesandShuntfeedbackamplifiers-Frequencyresponse,Inputand output impedance
2. RCPhaseshiftoscillatorandWienBridgeOscillator
3. HartleyOscillatorand ColpittsOscillator
4. RCIntegratorandDifferentiatorcircuitsusingOp-Amp

5. ClippersandClampers
6. Instrumentationamplifier
7. Activelow-pass,Highpass&Bandpassfilters
8. PLLCharacteristicsanditsuseasfrequencymultiplier, clocksynchronization
9. R-2RladdertypeD-AconverterusingOp-Amp

SIMULATIONUSING SPICE(UsingTransistor):

1. TunedCollectorOscillator
2. Twin-TOscillator/WeinBridgeOscillator
3. DoubleandStaggertunedAmplifiers
4. BistableMultivibrator
5. SchmittTriggercircuitwithPredictablehysteresis
6. Analysisofpower amplifier

ComponentsandAccessories:

Transistors, Resistors, Capacitors, Inductors, diodes, Zener Diodes, Bread Boards, Transformers.SPICECircuitSimulationSoftware:(anypublicdomainorcommercial software)

Note: Op-AmpsuA741,LM301,LM311,LM324,LM317,LM723,7805,7812, 2N3524, 2N3525,2N3391, AD 633, LM 555, LM 565 may be used

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecoursethestudentswillbeableto

CO1:Analyzevarioustypesoffeedbackamplifiers

CO2:Designoscillators,tunedamplifiers,wave-shapingcircuitsandmultivibrators

CO3:Design and simulate feedback amplifiers,oscillators, tuned amplifiers, wave-shapingcircuits and multivibrators, filters using SPICE Tool.

CO4:Designamplifiers,oscillators,D-Aconvertersusingoperationalamplifiers.

CO5:Designfiltersusingop-ampandperformanexperimentonfrequencyresponse

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	-	-	-	-	-	-	1	1	-	-	-
CO2	2	3	3	3	-	-	-	-	-	-	1	1	-	-	-
CO3	2	3	3	3	-	-	-	-	-	-	1	1	-	-	-
CO4	2	3	3	3	2	-	-	-	-	-	1	1	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg	2	3	3	3	2	-	-	-	-	-	1	1	-	-	-

1-low,2-medium,3-high,'-'-no correlation

21152C51	WIRELESS COMMUNICATION	LTPC
		3024

COURSEOBJECTIVES:

- Tostudyandunderstand theconceptsanddesignofaCellular System.
- ToStudyAndUnderstandMobileRadio PropagationAndVariousDigital ModulationTechniques.
- ToUnderstandTheConceptsOfMultipleAccessTechniquesAndWirelessNetworks

UNIT-I THECELLULARCONCEPT-SYSTEMDESIGNFUNDAMENTALS 9

Introduction-Frequencyreuse-Channel Assignment Strategies-**Handoff Strategies:**Prioritizing Handoffs, Practical Handoff Considerations. **Interference And System Capacity**: Co-Channel Interference And System Capacity-Channel Planning For Wireless Systems, Adjacent Channel Interference, Power Control For Reducing Interference, Trunking And Grade Of Service. **Improving Coverage And Capacity In Cellular Systems:** Cell Splitting, Sectoring.

UNIT-II MOBILERADIOPROPAGATION 9

LargeScalePathLoss:IntroductionToRadioWavePropagation-FreeSpacePropagationModel

– Three Basic Propagation Mechanism: Reflection – Brewster Angle- Diffraction- Scattering.Small Scale Fading And Multipath: Small Scale Multipath Propagation, Factors Influencing Small-Scale Fading, Doppler Shift, Coherence Bandwidth, Doppler Spread And Coherence Time. Types Of Small- Scale Fading: Fading Effects Due To Multipath Time Delay Spread, Fading Effects Due To Doppler Spread.

UNIT-III MODULATIONTECHNIQUESANDEQUALIZATIONANDDIVERSITY9

Digital Modulation – An Overview: Factors That Influence The Choice Of Digital Modulation, Linear Modulation Techniques: Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying(GMSK), Spread Spectrum Modulation Techniques: Pseudo- Noise (PN) Sequences, Direct Sequence Spread Spectrum (DS-SS)- Modulation Performance In Fading And Multipath Channels- Equalization, Diversity And Channel Coding: Introduction-Fundamentals Of Equalization- Diversity Techniques: Practical Space Diversity Considerations, Polarization Diversity, Frequency Diversity, Time Diversity.

UNIT-IV MULTIPLEACCESSTECHNIQUES 9

Introduction: Introduction To Multiple Access- Frequency Division Multiple Access(FDMA)- Time Division Multiple Access(TDMA)- Spread Spectrum Multiple Access-Code Division Multiple Access(CDMA)- Space Division Multiple Access(SDMA)- Capacity Of Cellular Systems: Capacity Of Cellular CDMA, Capacity Of CDMA With Multiple Cells.

UNIT-V WIRELESSNETWORKING 9

Introduction: Difference Between Wireless And Fixed Telephone Networks, The Public Switched Telephone Network(PSTN), Development Of Wireless Networks: First Generation Wireless Networks, Second Generation Wireless Networks, ThirdGenerationWirelessNetworks, Fixed NetworkTransmission Hierarchy, TrafficRoutingInWireless Networks: Circuit Switching, Packet Switching- Personal Communication Services/ Networks(PCS/PCNs):Packet Vs Circuit Switching For PCN, Cellular Packet- Switched Architecture- Packet Reservation Multiple Access(PRMA)- Network Databases: Distributed Database For Mobility Management-Universal Mobile Telecommunication Systems(UMTS).

45PERIODS

PRACTICALEXERCISES: 30PERIODS

1. Modelingofwirelesscommunicationsystems usingMatlab(Two raychannel andOkumura –Hata model)
2. ModelingandsimulationofMultipathfadingchannel
3. Design, analyze and test Wireless standards and evaluate the performance measurements suchasBER,PER,BLER,throughput,capacity, ACLR,EVMfor4Gand5GusingMatlab
4. Modulation:SpreadSpectrum–DSSSModulation&Demodulation

5. Wireless Channel equalization: Zero-Forcing Equalizer (ZFE),MMSE Equalizer(MMSEE),AdaptiveEqualizer(ADE),DecisionFeedbackEqualizer (DFE)

6. ModelingandsimulationofTDMA,FDMAandCDMAforwirelesscommunication

TOTAL:75 PERIODS

COURSEOUTCOMES:

Uponsuccessfulcompletionofthecoursethestudentwillbeableto: CO1:Understand TheConcept And Design Of A Cellular System.

CO2:UnderstandMobileRadioPropagationAndVariousDigitalModulation Techniques.**CO3**:Understand The Concepts Of Multiple Access Techniques And Wireless Networks **CO4**:Characterize a wireless channel and evolve the system designspecifications**CO5**:Designacellularsystembasedonresourceavailability and traffic demands.

TEXTBOOK :

1. Rappaport,T.S.,-Wirelesscommunications",PearsonEducation,SecondEdition,2010.

REFERENCES:

1. WirelessCommunication–AndreaGoldsmith,CambridgeUniversityPress, 2011
2. VanNee,R.andRamjiPrasad,—OFDMforwirelessmultimediacommunications, ArtechHouse, 2000
3. DavidTseandPramodViswanath,—FundamentalsofWirelessCommunication,Cambridge University Press, 2005.
4. UpenaDalal,—WirelessCommunication",OxfordUniversityPress,2009.
5. Andreas.F.Molisch,—WirelessCommunications",JohnWiley–India,2006.
6. WirelessCommunicationandNetworks–WilliamStallings,PearsonEducation,Second Edition2002.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	2	2	3	3	1	-	-	-	-	-	1	3	1	1
2	3	3	2	1	3	2	-	-	-	-	-	-	3	1	2
3	3	3	3	3	2	2	-	-	-	-	-	1	3	1	2
4	2	3	2	2	2	2	-	-	-	-	-	1	2	1	1
5	2	-	3	3	2	1	-	-	-	-	-	1	2	2	2
CO	**3**	**3**	**2**	**2**	**2**	**2**	-	-	-	-	-	**1**	**3**	**1**	-

1-low,2-medium, 3-high,'-'-nocorrelation

21152C52	VLSIANDCHIPDESIGN	LTPC
		300

COURSEOBJECTIVES:

- UnderstandthefundamentalsofICtechnologycomponentsandtheircharacteristics.
- Understandcombinationallogiccircuitsanddesignprinciples.
- Understandsequentiallogiccircuitsandclockingstrategies.

- UnderstandASICDesignfunctioninganddesign.
- UnderstandMemoryArchitectureandbuildingblocks

UNITI MOSTRANSISTORPRINCIPLES 9

MOS logic families (NMOS and CMOS), Ideal and Non Ideal IV Characteristics, CMOS devices. MOS(FET) Transistor Characteristic under Static and Dynamic Conditions, Technology Scaling, power consumption

UNITII COMBINATIONALLOGICCIRCUITS 9

Propagation Delays, stick diagram, Layout diagrams, Examples of combinationallogic design, Elmore's constant, Static Logic Gates,Dynamic Logic Gates, Pass TransistorLogic, Power Dissipation, Low Power Design principles.

UNITIII SEQUENTIALLOGICCIRCUITSANDCLOCKINGSTRATEGIES 9

Static Latches and Registers, Dynamic Latches and Registers, Pipelines, Nonbistable Sequential Circuits.Timing classification of Digital Systems, Synchronous Design, Self-Timed Circuit Design .

UNIT IV INTERCONNECT,MEMORYARCHITECTUREANDARITHMETIC9 CIRCUITS

Interconnect Parameters – Capacitance, Resistance, and Inductance, Electrical WireModels, Sequential digital circuits: adders, multipliers, comparators, shift registers. Logic Implementation using Programmable Devices (ROM, PLA, FPGA), Memory Architecture and Building Blocks,Memory Core and Memory Peripherals Circuitry

UNITV ASICDESIGNANDTESTING 9

Introduction to wafer to chip fabrication process flow. Microchip design process & issues in testandverificationofcomplexchips,embeddedcoresandSOCs, Faultmodels,Testcoding. ASIC Design Flow, Introduction to ASICs, Introduction to test benches, Writing test benches in Verilog HDL, Automatic test pattern generation, Design for testability, Scan design: Test interface and boundary scan.

TOTAL:45PERIODS

COURSEOUTCOMES:

UponsuccessfulcompletionofthecoursethestudentwillbeabletoCO1:In depth knowledge of MOS technology

CO2: Understand Combinational Logic Circuits and Design Principles**CO3**: Understand Sequential Logic Circuits and ClockingStrategies**CO4**:UnderstandMemoryarchitectureand building blocks

CO5:UnderstandtheASICDesignProcessandTesting.

TEXTBOOKS

1. JanDRabaey,AnanthaChandrakasan,"DigitalIntegratedCircuits:ADesignPerspective",

PHI, 2016.(UnitsII,IIIandIV).
2. Neil H E Weste, Kamran Eshranghian, " Principles of CMOS VLSI Design: A System Perspective," Addison Wesley, 2009.(Units - I, IV).
3. MichaelJSmith,"ApplicationSpecificIntegratedCircuits,AddisonWesley,(Unit-V)
4. SamirPalnitkar,"VerilogHDL:Aguideto DigitalDesignandSynthesis", SecondEdition, Pearson Education,2003.(Unit - V)
5. ParagK.Lala,"DigitalCircuitTestingandTestability",AcademicPress,1997,(Unit-V)

REFERENCES

1. D.A.Hodges and H.G.Jackson,Analysis and Design of Digital Integrated Circuits, International Student Edition, McGraw Hill 1983
2. P. Rashinkar, Paterson and L. Singh, "System-on-a-Chip Verification-Methodologyand Techniques", Kluwer Academic Publishers,2001
3. SamihaMouradandYervantZorian,"PrinciplesofTestingElectronicSystems",Wiley2000
4. M.Bushnell andV.D.Agarwal,"Essentialsof ElectronicTestingforDigital,Memory andMixed-Signal VLSI Circuits", Kluwer Academic Publishers,2000

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	1	-	-	-	-	-	-	-	-	-	-	3	3	3
2	3	2	3	2	-	-	-	-	-	-	-	1	3	3	3
3	2	3	2	3	1	1	-	-	-	-	-	2	3	2	3
4	-	-	1	1	-	-	-	-	-	-	-	3	3	3	2
5	-	-	-	-	-	2	-	-	-	-	1	-	3	2	2
CO	**2**	**2**	**2**	**2**	**1**	**.5**	-	-	-	-	**1**	**2**	**3**	**3**	**3**

1-low,2-medium,3-high,'-'-no correlation

21152C53 TRANSMISSIONLINESANDRFSYSTEMS LTPC

3003

COURSEOBJECTIVES:

- Tointroducethevarioustypesoftransmissionlinesanditscharacteristics
- Tounderstandhighfrequencyline,powerandimpedancemeasurements
- Toimparttechnicalknowledge inimpedancematchingusingSmithChart.
- TointroducepassivefiltersandbasicknowledgeofactiveRFcomponents
- Tolearnthe concepts ofaRFsystemtransceiverdesign.

UNITI TRANSMISSIONLINETHEORY 9

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 0-Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission -

Inputandtransferimpedance - Open and shortcircuited lines -reflectionfactorand reflection loss.

UNITII HIGHFREQUENCYTRANSMISSIONLINES 9

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

dissipation less line - Open and short circuited lines - Power and impedance measurement on lines -Reflection losses - Measurement of VSWR and wavelength.

UNITIII IMPEDANCEMATCHINGINHIGHFREQUENCYLINE 9

Impedance matching: Quarter wave transformer ,One Eighth wave line, Half wave line- Impedance matching by stubs- Single stub and double stub matching - Smith chart – Application of Smith chart, Solutions of problems using Smith chart - Single and double stub matching using Smith chart.

UNITIV WAVEGUIDES 9

Waves between parallel planes of perfect conductors- Transverse Electric waves and Transverse Magnetic waves, Characteristics of TE and TM waves, Transverse Electromagnetic waves, TM and TE waves in Rectangular waveguides, TM and TE waves in Circular waveguides.

UNITV RFSYSTEMDESIGNCONCEPTS 9

Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobilitytransistors, Fundamentals of MMIC, Basic concepts of RF design: Filters, couplers, power dividers, Amplifier power relations, Low noise amplifiers, Power amplifiers.

COURSEOUTCOMES:

CO1:Explainthecharacteristicsoftransmissionlinesanditslosses.

CO2:Calculatethestandingwaveratioandinputimpedanceinhighfrequency transmission lines.

CO3:AnalyzeimpedancematchingbystubsusingSmithCharts.

CO4:ComprehendthecharacteristicsofTEandTMwaves.

CO5:DesignaRFtransceiversystemforwirelesscommunication

TOTAL:45PERIODS

TEXTBOOKS

1. JohnDRyder,"Networkslinesandfields",PrenticeHallofIndia,NewDelhi,2005.(UnitI–IV)
2. MathewM. Radmanesh, "Radio Frequency&Microwave Electronics",Pearson Education Asia, Second Edition, 2002 (Unit – V)
3. AnnapurnaDas, SisirK.Das,"MicrowaveEngineering",McGrawHillEducation(India) private limited, Third edition,2000.(Unit – V)

REFERENCES

1. ReinholdLudwigandPowelBretchko,"RFCircuit Design" –Theoryand Applications",Pearson Education Asia, First Edition, 2001.
2. D.K.Misra, "Radio Frequencyand Microwave CommunicationCircuits"-Analysisand Design, John Wiley & Sons, 2004.
3. RichardChi-HsiLi-,"RFCircuitDesign"– AJohnWiley&Sons,Inc, Publications

4. W.Alan Davis, Krishna Agarwal, “Radio Frequency Circuit Design”, John willy & Sons,2001

CO’s-PO’s&PSO’sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	3	3	2	1	-	-	-	1	-	1	2	1	1
2	3	2	2	3	2	1	-	-	-	1	-	1	2	1	1
3	3	3	3	2	1	2	-	-	-	1	-	1	2	1	1
4	3	3	2	3	2	1	-	-	-	1	-	1	2	1	1
5	3	2	3	2	2	1	-	-	-	1	-	1	2	1	1
CO	**3**	**3**	**3**	**3**	**2**	**1**	-	-	-	**1**	-	**1**	**2**	**1**	**1**

21152L58	VLSILABORATORY	LTP C
		0042

COURSEOBJECTIVES:

- TolearnHardwareDescriptiveLanguage(Verilog/VHDL).
- Tolearnthe fundamentalprinciplesofDigitalSystemDesingusing HDLandFPGA.
- TolearnthefundamentalprinciplesofVLSIcircuitdesignindigitaldomain
- TolearnthefundamentalprinciplesofVLSIcircuitdesigninanalogdomain
- ToprovidehandsondesignexperiencewithEDAplatforms.

LISTOFEXPERIMENTS:

1. Design ofbasiccombinationalandsequential (Flip-flops)circuitsusingHDL. Simulateit using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
2. Design an Adder ; Multiplier (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Softwareand implement by Xilinx/Altera FPGA
3. DesignandimplementUniversal ShiftRegisterusingHDL.SimulateitusingXilinx/Altera Software
4. DesignMemoriesusingHDL.SimulateitusingXilinx/AlteraSoftwareandimplementby Xilinx/Altera FPGA
5. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
6. Design 3-bit synchronous up/down counter using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
7. Design4-bit Asynchronousup/downcounterusingHDL. Simulateit usingXilinx/Altera Software and implement by Xilinx/Altera FPGA
8. Design and simulate a CMOS Basic Gates & Flip-Flops. Generate Manual/AutomaticLayout .
9. Design and simulate a 4-bitsynchronous counter using a Flip-Flops.Generate Manual/Automatic Layout
10. DesignandSimulateaCMOSInvertingAmplifier.
11. DesignandSimulatebasicCommonSource,CommonGateandCommonDrainAmplifiers.
12. Designandsimulatesimple5transistordifferentialamplifier.

COURSEOUTCOMES:

Oncompletionofthecourse, studentswillbeableto:

CO1: WriteHDLcodeforbasicaswellasadvanceddigitalintegratedcircuit
CO2: ImportthelogicmodulesintoFPGABoards
CO3: SynthesizePlaceandRoutethedigitalIps
CO4: Design,SimulateandExtractthelayoutsofDigital&AnalogICBlocks using EDAtools
CO5: TestandVerificationofICdesign

TOTAL:60PERIODS

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	-	-	-	-	-	-	-	-	-	-	-	2	3	2
2	3	3	1	1	-	-	-	-	-	-	-	-	2	1	2
3	1	2	2	2	-	-	-	-	-	-	1	1	2	2	2
4	-	1	3	3	1	-	-	-	-	-	1	1	2	2	2
5	3	3	3	3	1	-	-	-	-	-	1	1	2	2	2
CO	**.2**	**.2**	**.2**	**.2**	**1**	-	-	-	-	-	**1**	**1**	**2**	**2**	**2**

1-low,2-medium, 3-high,'-'-nocorrelation

21152S61 EMBEDDEDSYSTEMSANDIOTDESIGN LTPC3024

COURSEOBJECTIVES:

- Learnthearchitectureand featuresof8051.
- Studythedesignprocessofanembeddedsystem.
- Understandthereal–timeprocessinginanembedded system.
- LearnthearchitectureanddesignflowofIoT.
- BuildanIoTbasedsystem.

UNITI 8051MICROCONTROLLER 9

Microcontrollers for an Embedded System – 8051 – Architecture – Addressing Modes – Instruction Set – Programand Data Memory –Stacks– Interrupts – Timers/Counters – Serial Ports – Programming.

UNITII EMBEDDEDSYSTEMS 9

Embedded System Design Process – Model Train Controller – ARM Processor – Instruction Set Preliminaries – CPU – Programming Input and Output – Supervisor Mode – Exceptions and Trap – Models for programs – Assembly, Linking and Loading – Compilation Techniques – Program Level Performance Analysis.

UNITIII PROCESSESANDOPERATINGSYSTEMS 9

Structure of a real – time system – Task Assignment and Scheduling – Multiple Tasks and Multiple Processes – Multirate Systems – Pre emptive real – time Operating systems – Priority based scheduling – Interprocess Communication Mechanisms – Distributed Embedded Systems – MPSoCs and Shared Memory Multiprocessors – Design Example –

Audio Player, Engine Control Unit and Video Accelerator.

UNITIV IOTARCHITECTUREANDPROTOCOLS 9

Internet – of – Things – Physical Design, Logical Design – IoT Enabling Technologies – Domain Specific IoTs – IoT and M2M– IoT SystemManagement withNETCONF – YANG – IoT Platform Design – Methodology – IoT Reference Model – Domain Model – Communication Model – IoT Reference Architecture – IoT Protocols - MQTT, XMPP, Modbus, CANBUS and BACNet.

UNITV IOTSYSTEMDESIGN 9

BasicbuildingblocksofanIoTdevice– RaspberryPi– Board–LinuxonRaspberryPi –Interfaces – Programming with Python – Case Studies: Home Automation, Smart Cities, Environment andAgriculture.

45PERIODS

PRACTICALEXERCISES **30PERIODS**

Experimentsusing8051.

1. ProgrammingArithmeticandLogicalOperationsin8051.
2. GenerationofSquarewaveformusing8051.
3. ProgrammingusingOn–Chipportsin8051.
4. ProgrammingusingSerialPortsin8051.
5. DesignofaDigitalClockusingTimers/Countersin8051.ExperimentsusingARM

- InterfacingADCandDACBlinkingofLEDsandLCD
- InterfacingkeyboardandStepperMotor.MiniprojectsforIoT
- GarbageSegregatorandBinLevelIndicatorColourbasedProductSorting
- ImageProcessingbasedFireDetectionVehicleNumberPlateDetection
- SmartLockSystem

COURSEOUTCOMES:

CO1:Explainthearchitectureandfeaturesof8051.

CO2: Develop a model of an embedded system.**CO3**:Listtheconceptsofrealtimeoperatingsyste ms. **CO4**: Learn the architecture and protocols of IoT.

CO5:DesignanIoTbasedsystemforanyapplication.

TOTAL:60PERIODS

TEXTBOOKS:

1. Mohammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D.McKinlay, The 8051 Microcontroller and Embedded Systems Using Assembly and C, Second Edition, Pearson Education, 2008.(Unit – I)
2. 2.Marilyn Wolf, Computers as Components – Principles of Embedded Computing System Design, Third Edition, Morgan Kaufmann, 2012.(Unit – II,III)
3. Arshdeep Bahga, VijayMadisetti, Internet –of- Things– A Handson Approach, Universities Press, 2015.(Unit – IV,V)

REFERENCES:

1. MayurRamgir,Internet –of–Things,Architecture,ImplementationandSecurity,First Edition, Pearson Education, 2020.
2. LylaB.Das, EmbeddedSystems:AnIntegratedApproach,PearsonEducation2013.
3. Jane.W.S.Liu,Real–TimeSystems,PearsonEducation,2003.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	-	-	-	-	-	-	-	3	2	1
2	3	3	3	2	2	-	-	-	-	-	-	-	3	2	1
3	3	3	2	2	2	-	-	-	-	-	-	-	2	1	1
4	3	3	2	2	2	-	-	-	-	-	-	-	3	3	2
5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO	**3**	**3**	**.6**	**.2**	**.2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.8**	**2.2**	**1.4**

1-low,2-medium,3-high,'-'-no correlation

21152S62 ARTIFICIAL INTELLIGENCEANDMACHINE LEARNING LTPC
3024

COURSEOBJECTIVES:

Themainobjectivesofthiscourseareto:

- StudyaboutuninformedandHeuristicsearchtechniques.
- Learntechniquesforreasoningunderuncertainty
- IntroduceMachineLearningandsupervisedlearningalgorithms
- Studyaboutensemblingandunsupervisedlearningalgorithms
- Learnthebasicsofdeeplearningusingneural networks

UNITI PROBLEMSOLVING 9

Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP)

UNITII PROBABILISTICREASONING 9

Actingunder uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning –Bayesiannetworks–exactinferenceinBN–approximateinferenceinBN–causal

networks.

UNITIII SUPERVISEDLEARNING 9

Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, LinearClassification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests

UNITIV ENSEMBLETECHNIQUESANDUNSUPERVISEDLEARNING 9

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization

UNITV NEURALNETWORKS 9

Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) –ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

45PERIODS

PRACTICALEXERCISES: 30PERIODS

1. ImplementationofUninformedsearchalgorithms(BFS,DFS)
2. ImplementationofInformedsearchalgorithms(A*,memory-boundedA*)
3. ImplementnaïveBayesmodels
4. ImplementBayesianNetworks
5. BuildRegressionmodels
6. Builddecisiontreesand randomforests
7. BuildSVMmodels
8. Implementensemblingtechniques
1. Implementclusteringalgorithms
2. ImplementEMforBayesiannetworks
3. BuildsimpleNNmodels
4. BuilddeeplearningNNmodels

OUTCOMES:

Attheendofthiscourse,thestudentswillbeable to:

CO1:Useappropriatesearchalgorithmsforproblemsolving

CO2:Applyreasoningunderuncertainty

CO3:Buildsupervisedlearningmodels

CO4:Buildensemblingandunsupervisedmodels

CO5:Builddeeplearningneuralnetworkmodels

TOTAL:75PERIODS

TEXTBOOKS:

1. StuartRussellandPeterNorvig,"ArtificialIntelligence–AModernApproach", FourthEdition, Pearson Education, 2021.
2. EthemAlpaydin,"IntroductiontoMachineLearning",MITPress,FourthEdition, 2020.

REFERENCES

1. DanW.Patterson,"IntroductiontoAIandES",PearsonEducation,2007
2. KevinNight,ElaineRich,andNairB.,"ArtificialIntelligence",McGrawHill,2008
3. PatrickH.Winston,"ArtificialIntelligence",Third Edition,PearsonEducation,2006
4. Deepak Khemani, "ArtificialIntelligence",Tata McGraw HillEducation, 2013 (http://nptel.ac.in/)
5. ChristopherM.Bishop,"PatternRecognitionandMachineLearning",Springer,2006.
6. TomMitchell,"MachineLearning",McGrawHill,3rdEdition,1997.
7. CharuC.Aggarwal, "DataClassificationAlgorithmsandApplications",CRCPress,2014
8. MehryarMohri,AfshinRostamizadeh,AmeetTalwalkar,"FoundationsofMachine Learning", MIT Press, 2012.
9. IanGoodfellow,YoshuaBengio,AaronCourville,"DeepLearning",MITPress,2016

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	2	1	1	1	-	-	-	-	-	-	-	-	-
2	3	3	2	1	2	1	-	-	-	-	-	-	-	-	-
3	3	3	2	2	2	1	-	-	-	-	-	1	-	-	-
4	3	3	1	1	2	1	-	-	-	-	-	-	-	-	-
5	3	3	1	1	2	1	-	-	-	-	-	-	-	-	-
CO	3	3	1.6	1.2	1.8	1	-	-	-	-	-	1	-	-	-

21152INT76	SUMMER INTERNSHIP	LTP C000 2

COURSEOBJECTIVES:

Toenablethestudentsto

- Getconnectedwithindustry/laboratory/researchinstitute
- Getpracticalknowledgeonproductionprocessintheindustryand developskillstosolve related problems
- Developskillstocarryoutresearchintheresearchinstitutes/laboratories

The students individually undergo training in reputed firms/ research institutes / laboratories for the specified duration. After the completion of training, a detailed report should be submitted within ten days from the commencement of next semester. The students will be evaluated as per the Regulations.

No.ofWeeks:04

COURSE

OUTCOMES:

Oncompletionofthecourse,thestudentwillknowabout

CO1: System-level design processes, verification and validation techniques, manufacturingandproductionprocessesinthefirmorresearchfacilitiesinthe laboratory/research institute

CO2:Analysisofindustrial/researchproblemsandtheirsolutions

CO3:Documentationofsystemspecifications,designmethodologies,process parameters,testing parameters and results

CO4:Preparingoftechnicalreportandpresentation

21152P81 PROJECTWORK/INTERNSHIP LTPC002010

COURSEOBJECTIVES:

Totrainthestudentsin

- Identifying problem and developing the structured methodology to solve the identifiedprobleminthe industryorresearchproblemat researchInstitutionorcollege.
- Conductingexperiments,analyzeanddiscussthetestresults,andmakeconclusions.
- Preparingprojectreportsandpresentation

The students shall individually / or as group work on a specific topic approved by the Department.The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definitionof theidentifiedproblem, detailed literature reviewrelated tothearea of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed bythe Universityand submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

TOTAL:300PERIODS

COURSEOUTCOMES:

Attheendoftheproject,thestudentwillbeable to

CO1: Formulate and analyze problem / create a new product/ process.CO2:Designandconductexperimentstofindsolution

CO3: Analyze the results and provide solution for theidentified problem, prepare project report andmake presentation.

21152E54A **OPTICALCOMMUNICATION&NETWORKS** **LTPC**
3 0 0 3

COURSEOBJECTIVES:

- ToStudyAboutTheVariousOpticalFiberModes,ConfigurationOfOpticalFibers
- ToStudyTransmissionCharacteristicsOfOpticalFibers.
- ToLearnAboutTheVariousOpticalSources,DetectorsAndTransmissionTechniques.
- ToExploreVariousIdeaAboutOpticalFiberMeasurementsAndVariousCoupling
- Techniques.
- ToEnrichTheKnowledgeAboutOpticalCommunicationSystemsAndNetworks.

UNIT-I INTRODUCTIONTOOPTICALFIBERCOMMUNICATION 9

Introduction - The General Systems - Advantages of Optical Fiber Communication- **Ray Theory Transmission** : Total Internal Reflection, Acceptance Angle, Numerical Aperture, Skew Rays - **Electromagnetic Mode Theory for Optical Propagation**: Modes in a Planar Guide, Phase andgroup velocity -**CylindricalFiber**: Step indexfibers, Gradedindexfibers -**Single mode fibers**: Cutoff wavelength.

UNIT-II TRANSMISSIONCHARACTERISTICSOFOPTICALFIBERS 9

Attenuation - **Material absorption losses in silica glass fibers:** Intrinsic absorption, Extrinsic absorption - **Linear scattering losses**: Rayleigh Scattering, Mie Scattering -**Nonlinear scattering losses**: Stimulated Brillouin Scattering, Stimulated Raman Scattering – Fiber Bend Loss – Dispersion- **Chromatic dispersion**: Material dispersion, Waveguide dispersion- **Intermodal dispersion** : Multimode step index fiber, Multimode graded index fiber.

UNIT-III OPTICALSOURCESANDOPTICALDETECTORS 9

The laser :Introduction - **Basic concepts**: Absorption and emission of radiation, Population inversion , Optical feedback and laser oscillation, Threshold condition for laser oscillation- **Optical emission from semiconductors**: The PN junction, Spontaneous emission, Carrier recombination, Stimulated emission and lasing, Hetero junctions- **LED**: Introduction- Power and Efficiency - **LED structures**: Planar LED, Dome LED, Surface emitter LED, Edge emitter LED- LED Characteristics. **Optical Detectors:**Introduction ,Optical Detection Principles, Quantum Efficiency, Resposivity, P-N Photodiode ,P-I-N Photo Diode and Avalanche Photodiode.

UNIT-IV OPTICALFIBERMEASUREMENTS 9

Introduction- Total Fiber Attenuation Measurement, Fiber Dispersion Measurements In Time Domain and Frequency Domain, Fiber Cut off Wavelength Measurements, Numerical Aperture Measurements. Fiber Diameter Measurements,.Reflectance And Optical Return Loss, Field Measurements

UNIT-V OPTICAL NETWORKS 9

Introduction- **Optical Network Concepts**: Optical Networking Terminology, Optical Network Node And Switching Elements, Wavelength Division Multiplexed Networks, Public Telecommunications Network Overview- **Optical Network Transmission Modes**, **Layers And Protocols**: Synchronous Networks, Asynchronous Transfer Mode, Open System Interconnection Reference Model, Optical Transport Network, Internet Protocol- **Wavelength Routing Networks**: Routing And Wavelength Assignment-**Optical Switching Networks**: Optical Circuit Switched Networks, Optical Packet Switched Networks, Multiprotocol Label Switching, Optical Burst Switching Networks- **Optical Network Deployment** : Long Haul Networks, Metropolitan area networks, Access networks, Local Area Networks- **Optical Ethernet**: Network protection, restoration and survivability.

TOTAL: 45 PERIODS

COURSEOUTCOMES

At the end of the course, the student will be able to understand the CO1:Realize Basic Elements In Optical Fibers, Different Modes And Configurations.

CO2:AnalyzeTheTransmissionCharacteristicsAssociatedWithDispersionAndPolarizationTechniques.
CO3:DesignOpticalSourcesAndDetectorsWithTheirUseInOpticalCommunicationSystem.
CO4:ConstructFiberOpticReceiverSystems,MeasurementsAndTechniques.
CO5:DesignOpticalCommunicationSystemsAndItsNetworks.

TEXTBOOKS:

1. JohnM.Senior,“OpticalFiberCommunication”,PearsonEducation,FouthEdition.2010.

REFERENCES:

1. GredKeiser,"OpticalFiberCommunication”,McGrawHillEducation(India)PrivateLimited.Fifth Edition, Reprint 2013.
2. GovindP.Agrawal,“Fiber-OpticCommunicationSystems”,ThirdEdition,JohnWiley&Sons,2004.
3. J.Gower,“OpticalCommunicationSystem”,PrenticeHallOfIndia,2001
4. RajivRamaswami,“OpticalNetworks“,SecondEdition,Elsevier,2004.
5. PChakrabarti,"OpticalFiberCommunication”,McGrawHillEducation(India)PrivateLimited,2016

CO’s-PO’s&PSO’sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	3	1	-	-	-	-	-	1	2	1	2
2	3	3	2	1	3	2	-	-	-	-	-	2	2	2	2
3	3	3	3	3	2	1	-	-	-	-	-	1	2	2	2
4	3	3	2	2	2	1	-	-	-	-	-	1	2	1	2
5	3	3	3	3	2	1	-	-	-	-	-	1	2	2	2
CO	3	3	2	3	3	1	-	-	-	-	-	1	2	1	2

1-low,2-medium,3-high,‘-'-nocorrelation

21152E54B 4G/5GCOMMUNICATIONNETWORKS LTP C 2023

COURSEOBJECTIVES

- Tolearntheevolution ofwirelessnetworks.
- Togetacquaintedwiththefundamentalsof5G networks.
- Tostudytheprocessesassociatedwith5Garchitecture.
- Tostudyspectrumsharingandspectrumtrading.
- Tolearnthesecurityfeaturesin5Gnetworks.

UNITI EVOLUTIONOF WIRELESSNETWORKS 6

Networks evolution: 2G,3G,4G, evolution of radio access networks, needfor 5G. 4G versus 5G,Next Generation core(NG-core), visualized Evolved Packet core(vEPC).

UNITII 5GCONCEPTSANDCHALLENGES 6

Fundamentals of 5G technologies, overview of 5G core network architecture,5G new radioandcloud technologies, Radio Access Technologies (RATs), EPC for 5G.

UNITIII NETWORKARCHITECTUREANDTHEPROCESSES 6

5G architecture and core, network slicing, multi access edge computing(MEC)visualization of 5G components, end-to-end system architecture, service continuity, relation to EPC, and edge computing. 5G protocols: 5G NAS,NGAP, GTP-U, IPSec and GRE.

UNITIV DYNAMICSPECTRUMMANAGEMENTANDMM-WAVES 6

Mobility management, Command and control, spectrum sharing and spectrum trading, cognitive radio based on 5G, millimeter waves.

UNITV SECURITYIN5GNETWORKS 6

Security features in 5G networks, network domain security, user domain security, flow based QoS framework,mitigating the threats in 5G.

30PERIODS

PRACTICALEXERCISES: **30PERIODS**

SIMULATIONUSINGMATLAB

1. 5G-Compliantwaveformgenerationandtesting
2. Modelingof5GSynchronizationsignalblocksandbursts
3. Channelmodelingin5Gnetworks
4. MultibandOFDMdemodulation
5. PerfectChannelestimation
6. Developmentof5gNewRadioPolarCoding

COURSEOUTCOMES

CO1:Tounderstandtheevolutionofwirelessnetworks.
CO2:Tolearntheconceptsof5Gnetworks.
CO3:To comprehend the 5G architecture and protocols.
CO4:Tounderstandthedynamicspectrummanagement. **CO5**:To learn the security aspects in 5G networks.

TOTAL60PERIODS

TEXTBOOKS

1. 5GCorenetworks:PoweringDigitalization,StephenRommer,AcademicPress,2019
2. An Introduction to 5G Wireless Networks : Technology, Concepts and Use cases, Saro Velrajan,First Edition, 2020.

REFERENCES

1. 5G Simplified: ABCsof Advanced Mobile Communications Jyrki. T.J.Penttinen,Copyrighted Material.
2. 5GsystemDesign:AnendtoendPerspective,WanLeeAnthony,SpringerPublications,2019.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO3
1	3	3	2	3	2	-	-	-	-	-	-	-	1	1	3
2	3	3	3	2	2	-	-	-	-	-	-	-	1	1	2
3	3	3	2	2	2	-	-	-	-	-	-		2	2	2
4	3	3	3	3	2	-	-	-	-	-	-	-	3	2	2
5	3	2	3	3	2	-	-	-	-	-	-	-	2	2	2
CO	3	2.8	2.6	2.6	2	-	-	-	-	-	-	-	1.8	1.6	2.2

1-low,2-medium,3-high,'-'-nocorrelation

21152E55A **SOFTWAREDEFINEDNETWORKS** **L TP C 2023**

COURSEOBJECTIVES:

- TounderstandtheneedforSDNanditsdataplaneoperations
- Tounderstandthefunctionsofcontrolplane
- TocomprehendthemigrationofnetworkingfunctionstoSDNenvironment
- Toexplorevarioustechniquesofnetworkfunctionvirtualization
- Tocomprehendtheconceptsbehindnetworkvirtualization

UNITI SDN:BACKGROUNDANDDATAPLANE 6

EvolvingNetworkRequirements-TheSDNApproach-SDNandNFV-RelatedStandards-SDN Data Plane – OpenFlow Logical Network Device – OpenFlow Protocol.

UNITII SDNCONTROLPLANE 6

SDNControlPlaneArchitecture:SouthboundInterface,NorthboundInterface-ControlPlane Functions–ITU-TModel–OpenDaylight–REST–CooperationandCoordinationamong Controllers.

UNITIII UNITTITLE 6

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – MeasurementandMonitoring – Security– DataCenterNetworkingMobilityandWireless – Information-centricNetworking

UNITIV NETWORKFUNCTIONVIRTUALIZATION 6

NFV Concepts – Benefits and Requirements – Reference Architecture – NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV

UNITV NETWORKVIRTUALIZATION 6

VirtualLANs-OpenFlowVLANSupport- VirtualPrivateNetworks-NetworkVirtualization-OpenDaylight'sVirtualTenantNetwork-CoSoftware-DefinedInfrastructure

30PERIODS

PRACTICALEXERCISES: 30PERIODS

1. InstallingMininetsimulator
2. Creatinga1controller,3nodetopology,POXcontroller
3. Abilitytoview,read/writeFlowtablerules(fordifferentapplications -sayfirewall,Learning switch etc.), POX, Open vSwitch
4. BuildingaSDNbasedapplication

COURSEOUTCOMES:

Afterthesuccessfulcompletionofthiscourse,thestudentwillbeableto CO1:

Describe the motivation behind SDN and its data plane (K2) **CO2**: Identify the functions of control plane (K3)

CO3: ApplySDNtonetworkingapplications(K3)
CO4:Applyvariousoperationsofnetworkfunctionvirtualization
CO5: Explainvarioususecasesof SDN

TOTAL:60PERIODS

TEXTBOOKS

1. WilliamStallings,"FoundationsofModernNetworking:SDN,NFV,QoE,IoTandCloud", Pearson Education, 1st Edition, 2015.
2. ThomasDNadeau,KenGray,"SDN:SoftwareDefinedNetworks",O'ReillyMedia,2013.

REFERENCES

1. FeiHu, "NetworkInnovationthroughOpenFlow andSDN:PrinciplesandDesign", 1stEdition, CRC Press, 2014.
2. PaulGoransson,ChuckBlackTimothyCulver,"SoftwareDefinedNetworks:A Comprehensive Approach", 2ndEdition, Morgan Kaufmann Press, 2016.
3. OswaldCoker,SiamakAzodolmolky,"Software-DefinedNetworkingwithOpenFlow",2ndEdition, O'Reilly Media, 2017.

CO's-PO's&PSO'sMAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	3	3	3	3	2	-	-	-	-	-	3	3	3	2
2	3	3	3	2	2	2	-	-	-	-	-	3	3	2	2
3	3	3	3	3	1	2	-	-	-	-	-	3	2	3	2
4	2	3	3	2	2	1	-	-	-	-	-	2	2	1	2
5	3	3	2	2	2	1	-	-	-	-	-	2	2	2	2
CO	3	3	3	2	2	2	-	-	-	-	-	2	2	2	2

1-low,2-medium,3-high,'-'-nocorrelation

21152E64C MASSIVEMIMONETWORKS LTP C 2023

COURSEOBJECTIVES:

- TogainknowledgeaboutmassiveMIMO networks.
- TounderstandthemassiveMIMOpropagationchannels.
- TolearnaboutchannelestimationinsinglecellandmulticellmassiveMIMOsystems.
- TocomprehendtheconceptsofmassiveMIMOdeploymentinthecontextof singlecelland multicell deployment.

UNITI MASSIVEMIMONETWORKS 6

DefinitionofMassiveMIMO, CorrelatedRayleighFading,SystemModelforUplinkandDownlink, Basic Impact of Spatial Channel Correlation, Channel Hardening and Favourable Propagation, Local Scattering Spatial Correlation Model

UNITII THEMASSIVEMIMOPROPAGATIONCHANNEL 6

Favorable Propagation and Deterministic Channels-Capacity Upper Bound-Distance from Favorable Propagation-Favorable Propagation and Linear Processing-Singular Values and Favorable Propagation, Favorable Propagation and Random Channels-Independent Rayleigh Fading-Uniformly Random Line-of-Sight (UR-LoS)-Independent Rayleigh Fading versus UR-LoS - Finite-Dimensional Channels

UNITIII SINGLE-CELLSYSTEMS 6

Uplink Pilots and Channel Estimation - Orthogonal Pilots- De-Spreading of the Received Pilot Signal-MMSE Channel Estimation, Uplink Data Transmission - Zero-Forcing -Maximum-Ratio, Downlink Data Transmission-Linear Precoding-Zero-Forcing-Maximum-Ratio, Discussion-Interpretation of the Effective SINR Expressions-Implications for Power Control-Scaling Laws and Upper Bounds on the SINR - Near-Optimality of Linear Processing when M >> K - Net Spectral Efficiency - Limiting Factors: Number of Antennas and Mobility

UNITIV MULTI-CELLSYSTEMS 6

Uplink Pilots and Channel Estimation, Uplink Data Transmission - Zero-Forcing -Maximum-Ratio, Downlink Data Transmission -Zero-Forcing - Maximum-Ratio, Discussion -Asymptotic Limits with Infinite Numbers of BaseStation Antennas - The Effects of Pilot Contamination - Non-Synchronous Pilot Interference

UNITV CASESTUDIES 6

Single-Cell Deployment Example: Fixed Broadband Access in Rural Area, Multi-Cell Deployment: PreliminariesandAlgorithms,Multi-CellDeploymentExamples:MobileAccess-DenseUrban

Scenario - Suburban Scenario - Minimum Per-Terminal Throughput Performance -Additional Observations - Comparison of Power Control Policies

30PERIODS

PRACTICALEXERCISES: **30PERIODS**

Implementationof(UsingMatlab)

1. MassiveMIMOhybridbeamforming
2. SinglecellmassiveMIMOdownlinkcommunications
3. MulticellmassiveMIMOdownlinkcommunications.
4. PrecodinginmassiveMIMOsinglecellandmulticelldownlinkcommunications
5. ChannelestimationinmassiveMIMOsystem

COURSEOUTCOMES:

CO1: UnderstandandexplainmassiveMIMOnetworks.

CO2: AnalyzemassiveMIMOpropagationchannelsandtheircapacitybounds

CO3:Examinechannelestimationtechniquesforsinglecellsystem.

CO4: Analyzechannelestimationtechniquesformulticellsystem.

CO5: Explaintheconceptsunderliningthedeploymentofsingleandmulticell massiveMIMO systems.

TOTAL:60PERIODS

TEXTBOOKS

1. ThomasL.Marzetta,ErikG.Larsson,HongYang,HienQuocNgo,"Fundamentalsof Massive MIMO", Cambridge University Press 2016. (UNITS II-V)

2. EmilBjörnson, JakobHoydis andLucaSanguinetti (2017),"MassiveMIMO Networks:Spectral, Energy, and Hardware Efficiency", Foundations and Trends, Now, 2017. (UNIT I)

REFERENCES

1. LongZhao,HuiZhao, KanZheng, "WeiXiangMassiveMIMOin5GNetworks:Selected Applications", Springer 2018.

2. LeiboLiu,GuiqiangPeng,ShaojunWei,"MassiveMIMODetectionAlgorithmandVLSI Architecture", Springer 2019.

3. ShahidMumtaz,JonathanRodriguez, LinglongDai, "mmWaveMassiveMIMOAParadigm for 5G", Elsevier, 2017

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	2	1	1	2	2	-	-	-	-	-	2	3	1	2
2	3	3	2	2	2	2	-	-	-	-	-	1	2	2	1
3	3	2	2	2	2	2	-	-	-	-	-	1	3	3	2
4	3	3	2	2	2	2	-	-	-	-	-	1	3	1	3
5	3	2	2	2	2	2	-	-	-	-	-	2	3	3	2
CO	3	2.4	1.8	1.8	2	2	-	-	-	-	-	1.4	3	2	2

1-low,2-medium,3-high,'-'-nocorrelation

21152E54C	AVIONICSSYSTEMS	LTP C 3003

COURSEOBJECTIVES:

- Toimpartknowledgeontheneedsforavionicsforboth Civilandmilitaryaircraft.
- Toimpartknowledgeon avionicsarchitectureandAvionicsdatabus.
- Toimpartknowledgeunderstandthevariouscockpitdisplaysandhuman interfaces.
- Toimpartknowledgeontheconceptsofflightcontrolsystems,FMSandtheirimportance

- Toimpartknowledgeondifferentnavigationaidsandneedforcertification

UNITI INTRODUCTIONTOAVIONICS 9

Basics of Avionics-Basics of Cockpits – Need for Avionics in civil and military aircraft and space systems-IntegratedAvionicsArchitecture-MilitaryandCivilsystem -TypicalavionicsSystem and Sub systems – Design and Technologies – Requirements and Importance of illities of Avionic Systems.

UNITII DIGITALAVIONICSBUSARCHITECTURE 9

Evolutionof Avionicsarchitecture-AvionicsDatabusesMIL-STD-1553,MIL-STD-1773, ARINC-429,ARINC-629,AFDX/ARINC-664,ARINC-818-AircraftsystemInterface

UNITIII COCKPITDISPLAYS ANDMAN-MACHINEINTERACTION 9

Trendsindisplaytechnology-CRT,LED,LCD,ELandplasmapanel-Touchscreen-Directvoice input (DVI) –-Civil cockpit and military cockpit: MFD, MFK, HUD, HDD, HMD, HOTAS–Glass cockpit.

UNITIV FLIGHTCONTROLSYSTEMS 9

IntroductiontoFlightcontrolsystemsandFMS-LongitudinalControl-Lateral Control -Autopilot- Flight planning – Radar ElectronicWarfare - Certification-Military and civil aircrafts.

UNITV NAVIGATIONSYSTEMS 9

Overviewofnavigationsystems-CommunicationSystems-Radionavigation-Types &Principles -FundamentalsofInertialSensors-INS-GNSS--GPS-ApproachandLandingAids-ILS&MLS – Hybrid Navigation

COURSEOUTCOMES: TOTAL:45PERIODS

Uponcompletion ofthecourse,studentswillbeableto:

CO1:ExplainthedifferentofAvionicsSystemsanditsneedforcivilandmilitary aircraftsconsidering the reliability and safety aspects

CO2:Select asuitablearchitectureanddatabusbasedontherequirements

CO3:Comparethedifferentdisplaytechnologiesusedincockpit

CO4:Explaintheprinciplesofflightcontrolsystemsandtheimportance ofFMS

CO5:Explainthecommunicationandnavigationtechniquesusedinaircrafts

TEXTBOOK:

1. R.P.G.Collinson,"IntroductiontoAvionics",SpringerPublications,ThirdEdition,2011.

REFERENCES:

1. CaryR.Spitzer,"TheAvionicsHandbook",CRCPress,2000.

2. Middleton, D.H."AvionicsSystems",LongmanScientificandTechnical,LongmanGroupUKLtd., England, 1989.

3. Spitzer,C.R."DigitalAvionicsSystems",PrenticeHall,EnglewoodCliffs,N.J.,U.S.A.,1987.
4. MyronKayton,WalterR.Fried"AvionicsNavigationSystems"2ndEdition, WileyPublication, 2008.
5. JimCurren,"TrendinAdvancedAvionics",IOWAStateUniversity,1992.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	3	3	3	2	-	-	-	-	-	3	3	3	2
2	3	3	3	2	2	2	-	-	-	-	-	3	3	2	2
3	3	3	3	3	1	2	-	-	-	-	-	3	2	3	2
4	2	3	3	2	2	1	-	-	-	-	-	2	2	1	2
5	3	3	2	2	2	1	-	-	-	-	-	2	2	2	2
CO	3	3	3	2	2	2	-	-	-	-	-	2	2	2	2

1-low,2-medium,3-high,'-'-nocorrelation

21152E64B SATELLITECOMMUNICATION LTP C
3003

COURSEOBJECTIVES:

Thestudentshould bemadeto:

- Understandthebasicsofsatelliteorbits
- Understandthesatellitesegment andearthsegment
- understandLinkPowerbudget calculation
- Understandthevarioussatelliteaccessandcodingtechnology
- Understandtheapplicationsofsatellite

UNITI SATELLITEORBITS 9

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits –Look Angle Determination- Limits of visibility –eclipse- Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

UNITII SPACE SEGMENT 9

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking andcommand-Transponders Antenna Subsystem.

UNITIII SATELLITELINK DESIGN 9

Basic link analysis, Uplink and Downlink Design equation, Free space loss-Atmospheric effects, Ionospheric scintillation, Rain induced attenuation and interference, system noise temperature, Link Design with and without frequency reuse.

UNITIV SATELLITEACCESSANDCODINGTechniques 9

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, PAMA and DAMA Assignment Methods, compression–encryption, CodingSchemes.

UNITV SATELLITEAPPLICATIONS 9

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, LEO, MEO, Satellite Navigational System.GPS-Position Location Principles, Differential GPS, Direct Broadcast satellites

(DBS/DTH).

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecourse,thestudentwillbeableto:

CO1:Identify the satellite orbits
CO2:Analyze the satellite subsystems
CO3:Evaluatethesatellitelinkpowerbudget
CO4:Identify access technology for satellite
CO5:Design various satellite applications

TEXTBOOKS:

1. DennisRoddy,“SatelliteCommunication”,4thEdition,McGrawHillInternational,2017.
2. TimothyPratt,Charles,W.Bostain,JeremyE.Allnutt,"SatelliteCommunication”,3rdEdition, Wiley Publications,2021.

REFERENCES:

1. TriT.Ha,“DigitalSatelliteCommunications”,2nd edition, McGrawHilleducation, 2017.

2. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "SatelliteCommunicationsSystemsEngineering",2nd edition, Prentice Hall/Pearson , 2013.
3. M.Richharia, "Satellite Communication Systems-Design Principles", Macmillan, 1999.
4. BrianAckroyd,"WorldSatelliteCommunicationandearthstation Design", BSP professionalBooks, 1990.
5. BruceR.Elbert,"TheSatelliteCommunicationApplications", Hand Book, Artech HouseBostan London, 2003.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	3	3	2	3	1	1	-	1	-	1	3	3	3
2	3	2	2	3	2	3	-	-	-	-	-	1	3	3	3
3	3	3	3	2	1	3	-	-	-	-	-	1	3	3	3
4	3	3	2	3	2	3	-	-	-	-	-	1	3	3	3
5	3	2	3	2	2	1	-	-	-	-	-	1	3	3	3
CO	**3**	**3**	**3**	**3**	**2**	**3**	1	1	-	1	**-**	**1**	**3**	**3**	**3**

1-low,2-medium,3-high,'-'-nocorrelation

21152E55B IMAGEPROCESSING LTPC

3003

COURSEOBJECTIVES:

- Tobecomefamiliarwithdigitalimagefundamentals
- TogetexposedtosimpleimageenhancementtechniquesinSpatialandFrequencydomain.
- Tolearnconceptsofdegradationfunctionandrestorationtechniques.
- Tostudytheimagesegmentationandrepresentationtechniques.
- Tobecomefamiliarwithimagecompressionandrecognitionmethods

UNIT I DIGITALIMAGEFUNDAMENTALS 9

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

UNITII IMAGEENHANCEMENT 9

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNITIII IMAGE RESTORATION 9

ImageRestoration-degradationmodel,Properties,Noisemodels–MeanFilters–OrderStatistics –Adaptivefilters–Band rejectFilters–BandpassFilters–NotchFilters–OptimumNotchFiltering –InverseFiltering–Wienerfiltering

UNIT IV IMAGESEGMENTATION 9

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation,Segmentation by morphological watersheds – basic concepts – Dam construction – Watershedsegmentation algorithm.

UNIT V IMAGECOMPRESSIONANDRECOGNITION 9

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture -Patterns and Pattern classes - Recognition based on matching.

TOTAL:45PERIODS

COURSEOUTCOMES

Attheendofthecourse,thestudentsshouldbeableto:

CO1:Knowandunderstandthebasicsandfundamentalsofdigitalimageprocessing,suchas digitization, sampling, quantization, and 2D-transforms.

CO2:Operateonimagesusingthetechniquesofsmoothing,sharpeningandenhancement.

CO3:Understandtherestorationconceptsandfilteringtechniques.

CO4: Learn the basics of segmentation, features extraction, compression and recognition methodsforcolor models.

CO5:Comprehendimagecompressionconcepts.

TEXTBOOKS:

1. RafaelC.Gonzalez,RichardE.Woods,'DigitalImageProcessing',Pearson,ThirdEdition,2010.
2. AnilK.Jain,'FundamentalsofDigitalImageProcessing',Pearson,2002.

REFERENCES

1. KennethR.Castleman,'DigitalImageProcessing',Pearson,2006.
2. RafaelC.Gonzalez,RichardE.Woods,StevenEddins,'DigitalImageProcessingusing MATLAB', Pearson Education, Inc., 2011.
3. D,E.DudgeonandRM.Mersereau,'MultidimensionalDigitalSignalProcessing',PrenticeHall Professional Technical Reference, 1990.
4. WilliamK.Pratt,'DigitalImageProcessing',JohnWiley,NewYork,2002
5. MilanSonkaetal'Imageprocessing,analysisand machinevision',Brookes/Cole,Vikas Publishing House, 2nd edition, 1999.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	3	2	2	2	-	-	-	-	-	3	2	3	2
2	3	3	3	2	2	2	-	-	-	-	-	2	2	3	2
3	3	3	2	2	2	2	-	-	-	-	-	2	2	2	1
4	3	3	3	2	2	2	-	-	-	-	-	2	2	2	1
5	3	3	3	3	2	2	-	-	-	-	-	2	2	2	1
CO	3	3	3	2	2	2	-	-	-	-	-	2	2	2	2

1-low,2-medium,3 -high,'-' -nocorrelation

21152E55C **SPEECHPROCESSING** **LTPC**
2 0 23

COURSEOBJECTIVES:

- Studythefundamentalsofspeechsignalandextracsvariousspeechfeatures
- Understanddifferentspeechcodingtechniquesforspeechcompressionapplications
- Learntobuildspeechenhancement,text-to-speechsynthesissystem

UNIT I FUNDAMENTALSOFSPEECH 6

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.

UNITII SPEECHFEATURESANDDISTORTIONMEASURES 6

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.

UNITIII SPEECHCODING 6

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 IV SPEECHENHANCEMENT 6

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 V SPEECHSYNTHESISANDAPPLICATION 6

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, Speechtransformations, Watermarking for authentication of a speech, Emotion recognition fromspeech.

30PERIODS

PRACTICALEXERCISES: 30PERIODS

1. WriteaMATLABProgramtoclassifyvoicedandunvoicedsegment ofspeechusingvarious time-domain measures
2. WriteaMATLABProgramtocalculatetheMFCCforaspeechsignal
3. ImplementITU-TG.722SpeechencoderinMATLAB
4. WriteaMATLABProgramtoimplementWienerFiltersforNoiseReduction
5. DesignaspeechemotionrecognitionsystemusingDCTandWPTinMATLAB

HARDWARE&SOFTWARESUPPORTTOOLS:

- PersonalComputerwithMATLAB
- MicrophoneandSpeakers

COURSEOUTCOMES:

Attheendofthiscourse,thestudentswillbeableto:

CO1:Understandthefundamentalsofspeech.
CO2:Extract variousspeechfeaturesforspeechrelatedapplications
CO3:Chooseanappropriatespeechcoderforagivenapplication.
CO4:Buildaspeechenhancementsystem.
CO5:Buildatext-to-speechsynthesissystemforvariousapplications

TOTAL:60PERIODS

TEXTBOOKS:

1. ShailaD.Apte,SpeechandAudioProcessing,WileyIndia(P)Ltd,NewDelhi,2012
2. PhiliposC.Loizou,SpeechEnhancementTheoryandPractice,Second Edition, CRC Press,Inc., United States, 2013

REFERENCES:

1. RabinerL.R.andJuangB.H,Fundamentalsofspeech recognition, PearsonEducation, 2003
2. ThomasF.Quatieri,Discrete-timespeechsignalprocessing- Principles and practice,Pearson, 2012.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	1	2	1	1	2	1	-	-	-	-	-	2	3	3	3
2	1	2	1	1	2	1	-	-	-	-	-	2	2	2	2
3	1	2	1	1	2	1	-	-	-	-	-	1	1	2	2
4	3	-	3	3	-	3	-	-	-	-	-	2	2	3	3
5	3	-	3	3	-	3	-	-	-	-	-	2	2	2	2
CO	**1.8**	**2**	**1.8**	**1.8**	**2**	**1.8**						**1.8**	**2**	**2.4**	**2.4**

1-low,2-medium,3-high,'-' -nocorrelation

21152E64A **SOFTWAREDEFINEDRADIO**

LTPC 2
0 2 3

COURSEOBJECTIVES:

- Tointroducetheconceptsofsoftware radios
- ToknowaboutRFimplementationchallengesforsoftwaredefinedradios
- Tounderstandthedigitalgenerationofsignals
- Tolearnthesoftwareandhardwarerequirementsforsoftwaredefinedradios.

UNIT I INTRODUCTIONTOSOFTWARERADIO6

TheNeedforSoftwareRadios.CharacteristicsandBenefitsofaSoftwareRadio. Design Principles of a Software Radio.

UNITII RFIMPLEMENTATION6

Purpose of RF front – end, Dynamic range, RF receiver front – end topologies, Enhanced flexibilityof the RF chain with software radios, Importance of the components to overall performance, Transmitter architectures and their issues, NoiseanddistortionintheRFchain,HybridDDS –PLLsystems,Applications of Direct Digital Synthesis.

UNITIII DIGITALGENERATIONOFSIGNALS6

Comparisonofdirectdigitalsynthesiswithanalogsignalsynthesis,Approaches

todirectdigitalsynthesis,Analysisofspurioussignals,Performanceofdirect digital synthesis systems,Applications of direct digital synthesis.

UNIT IV SMARTANTENNAS6

Benefitsofsmartantennas,Structuresforbeamformingsystems,Smartantenna algorithms, Hardware implementation of smart antennas, Digital Hardware Choices-Key hardware elements.

UNIT V HARDWAREANDSOFTWAREFORSDR&CASESTUDIES6

DSP Processors, FPGA, ASICs. Trade-offs, Object oriented programming, ObjectBrokers,GNURadio-USRP.CaseStudies:SPEAKeasy,JRTS,SDR- 3000.

30PERIODS

COURSEOUTCOMES:

Attheendofthiscourse,thestudentswillbeableto:

CO1:Understandthefundamentalsof speech.
CO2:Extractvariousspeechfeaturesforspeechrelatedapplications
CO3:Chooseanappropriatespeechcoderforagivenapplication.
CO4:Buildaspeechenhancementsystem.
CO5:Buildatext-to-speechsynthesissystemforvariousapplications

TEXTBOOKS:

3. ShailaD.Apte,SpeechandAudioProcessing,WileyIndia(P)Ltd,NewDelhi,2012
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1	1	2	1	1	2	1	-	-	-	-	-	2	3	3	3
2	1	2	1	1	2	1	-	-	-	-	-	2	2	2	2
3	1	2	1	1	2	1	-	-	-	-	-	1	1	2	2
4	3	-	3	3	-	3	-	-	-	-	-	2	2	3	3
5	3	-	3	3	-	3	-	-	-	-	-	2	2	2	2
CO	**1.8**	**2**	**1.8**	**1.8**	**2**	**1.8**						**1.8**	**2**	**2.4**	**2.4**

1-low,2-medium,3-high,'-'-nocorrelation

21152E65D **ADVANCEDDIGITALSIGNALPROCESSING** **L T PC**
20 23

COURSEOBJECTIVES:

- Tointroducetheconceptsofdiscretetimerandomsignalprocessing
- Toknowaboutmultiratesignalprocessinganditsapplications
- Tounderstandthespectrumestimationtechniques
- Tolearntheconceptofpredictiontheoryandfiltering

UNITI MULTIRATESIGNALPROCESSING 6

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.

UNITII DISCRETETIMERANDOMPROCESSES 6

Stationary random processes, Autocorrelation, Rational Power Spectra, Filters for generatingrandom Processes from white noise and inverse filter – AR, MA and ARMA processes – relationship between autocorrelation and the filter parameters.

UNITIII LINEARPREDICTIONANDFILTERING 6

LinearPrediction –ForwardandBackward -Wienerfiltersforfilteringand prediction–FIRWienerFilter – IIR Wiener Filter – Kalman Filter.

UNITIV ADAPTIVEFILTERING 6

FIR adaptive filters – adaptive filters based on steepest descent method – LMS algorithm – Variants of LMS algorithm– adaptive echo cancellation – adaptive channel equalization – RLS Algorithm.

UNITV SPECTRUMESTIMATION 6

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.

30PERIODS

PRACTICALEXERCISES: 30PERIODS

1. StudyofautocorrelationandCrossCorrelationofrandomsignals
2. DesignandImplementationofMultirateSystems.
3. DesignandImplementationofWiener Filter
4. DesignandImplementationofFIRLinearPredictor
5. DesignofadaptivefiltersusingLMSalgorithm
6. SpectrumEstimationusingBartlettandWelchMethods

COURSEOUTCOMES:

Upon successfulcompletion of the coursethestudentwillbe ableto

CO1:Comprehendmultirate signal processing anddemonstrate its applications

CO2:Demonstrateanunderstandingofthepowerspectraldensityandapplytodiscreterandomsignals and systems

CO3:Applylinear predictionandfilteringtechniquestodiscreterandomsignalsfor signal detection and estimation.

CO4:Analyzeadaptivefilteringproblemsanddemonstrateitsapplication

CO5:Applypower spectrumestimationtechniquestorandomsignals.

TOTAL:60PERIODS

TEXTBOOKS:

1. JohnG.Proakis&DimitrisG.Manolakis,—DigitalSignal Processing–Principles,Algorithms& Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. P.Vaidyanathan,"Multiratesystemsandfilterbanks",PrenticeHallInc.1993.

REFERENCES:

1. MonsonH.Hayes, "Statisticaldigitalsignalprocessingandmodeling",JohnWileyandSonsInc. New York, Indian reprint 2008.
2. Haykin,AdaptiveFilterTheory,4thEdition,PearsonEducation,NewDelhi, 2006.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	3	2	2	2	-	-	-	-	-	1	2	3	3
2	3	3	3	2	2	2	-	-	-	-	-	2	3	2	2
3	3	3	3	2	2	2	-	-	-	-	-	2	2	2	1
4	3	3	3	2	2	2	-	-	-	-	-	2	3	2	2
5	3	3	2	2	1	1	-	-	-	-	-	1	2	3	1
CO	3	3	3	2	2	2	-	-	-	-	-	2	3	2	2

3. SophonclesJ.Orfanidis,“OptimumSignalProcessing“,McGrawHill,2000.

CO’s-PO’s&PSO’sMAPPING

1-low,2-medium,3-high,‘-'-nocorrelation

21152E64A SOFTWAREDEFINEDRADIO LT PC 20 23

COURSEOBJECTIVES:

- Tointroducetheconceptsofsoftwareradios
- ToknowaboutRFimplementationchallengesfor softwaredefinedradios
- Tounderstandthedigitalgenerationofsignals
- Tolearnthesoftwareandhardwarerequirementsforsoftwaredefinedradios.

UNITI INTRODUCTIONTOSOFTWARERADIO 6

The Need for Software Radios. Characteristics and Benefits of a Software Radio. Design Principles of a Software Radio.

UNITII RF IMPLEMENTATION 6

PurposeofRFfront–end,Dynamicrange,RFreceiverfront–endtopologies,Enhancedflexibilityof 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.

UNITIII DIGITALGENERATIONOFSIGNALS 6

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.

UNITIV SMARTANTENNAS 6

Benefits of smart antennas, Structures for beamforming systems, Smart antenna algorithms, Hardware implementation of smart antennas, Digital Hardware Choices-Key hardware elements.

UNITV HARDWAREANDSOFTWAREFORSDR&CASESTUDIES 6

DSPProcessors,FPGA,ASICs.Trade-offs,Objectorientedprogramming,ObjectBrokers,GNURadio- USRP. Case Studies: SPEAK easy, JRTS, SDR-3000.

30PERIODS

PRACTICALEXERCISES: **30PERIODS**

1. StudyofSDRhardwarekit
2. DesignandImplementationofdigitalmodulationschemesusingSDR
3. ImplementationofsynchronizationtechniquesusingSDR
4. ChannelCodingTechniquesusingSDR
5. Studyofchannelestimationtechniquesusing SDR
6. StudyofMIMOconceptsusingSDR

COURSEOUTCOMES:
Attheendofthiscourse,thestudentswill beableto:

CO1: Demonstrateanunderstandingintheevolving paradigmof Softwaredefined radio andtechnologies for its implementation.
CO2:AnalyseRadiofrequencyimplementationissues
CO3:ImplementSmartantennatechniquesforsoftwaredefinedradio.
CO4:Comparevariousdigitalsynthesisprocedures.
CO5:Comprehendvarioushardwareandsoftwarerequirementsforsoftwaredefinedradios.

TOTAL:60PERIODS

TEXTBOOKS:

1. JeffreyHughReed,"SoftwareRadio: AModernApproachtoRadio Engineering," PrenticeHall Professional, 2002.
2. TonyJRouphael,"RFandDSPforSDR,"ElsevierNewnesPress, 2008.

REFERENCES

1. P.Kenington,"RFandBasebandTechniquesforSoftwareDefinedRadio," Artech House,2005.
2. PaulBurns,"SoftwareDefinedRadiofor3G,"ArtechHouse,2002.
3. Behrouz.F.Bourjney"SignalProcessingforSoftwaredefinedRadios",Lulu2008.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO3
1	3	3	2	2	2	2	-	-	-	1	-	3	3	2	2
2	3	3	3	2	2	2	-	-	-	1	-	2	3	2	2
3	3	3	3	2	2	2	-	-	-	1	-	2	3	2	3
4	3	3	3	2	2	2	-	-	-	1	-	2	2	2	2
5	3	3	3	3	2	2	-	-	-	1	-	2	2	2	2
CO	3	3	3	2	2	2	-	-	-	1	-	2	2	2	2

1-low,2-medium,3 -high,'-'-nocorrelation

21152E65A ADVANCEDWIRELESSCOMMUNICATIONTECHNIQUES L TPC

3003

COURSEOBJECTIVES

- Tounderstandtheevolvingparadigmofcooperativecommunication
- Tounderstandconceptsrelatedtogreenwirelesscommunication
- Toenablethestudenttounderstandthedifferentpowersavingstrategiesandenergy efficient signal, system and network design.
- Toexposethestudenttotheenergysavingtechniquesadoptedinexistingwireless components
- Toprovideunderstandingonprotocolsandnetworksrelatedtogreenfuture wireless communication technologies.

UNITI COOPERATIVECOMMUNICATIONS ANDGREENCONCEPTS 9

Network architectures and research issues in cooperative cellular wireless networks ; Cooperative communications in OFDM and MIMO cellular relay networks: issues and approaches; Fundamental trade-offs on the design of green radio networks, Green modulation and coding schemes.

UNITII COOPERATIVETECHNIQUES 9

Cooperative techniques for energy efficiency, Cooperative base station techniques for cellular wireless networks; Turbo base stations; Antenna architectures for cooperation; Cooperative communications in 3GPP LTE-Advanced, Partial information relaying and Coordinated multi-point transmission in LTE-Advanced.

UNITIII RELAY-BASEDCOOPERATIVECELLULARNETWORKS 9

Distributed space-time block codes ; Collaborative relaying in downlink cellular systems ; Radio resource optimization; Adaptive resource allocation ; Cross-layer scheduling design for cooperative wireless two-way relay networks ; Network coding in relay-based networks.

UNITIV GREENRADIONETWORKS 9

Base Station Power-Management Techniques- Opportunistic spectrum and load management, Energy-saving techniques in cellular wireless basestations , Power-management for base stations in smart grid environment, Cooperative multi cell processing techniques for energy-efficient cellular wireless communications.

UNITV ACCESSTECHNIQUES FORGREENRADIONETWORKS 9

Cross-layer design of adaptive packet scheduling for green radio networks; Energy-efficient relaying for cooperative cellular wireless networks ; Energy performance in TDD-CDMA multihop cellular networks ; Resource allocation for green communication in relay-based cellular networks ; Green Radio Test-Beds and Standardization Activities.

TOTAL:45PERIODS

COURSEOUTCOMES:

CO1:Thestudentwouldbeabletoappreciatethenecessityandthedesignaspectsofcooperative communication
CO2:Thestudentwouldbeabletoappreciatethenecessityandthedesignaspectsofgreen wireless communication.
CO3:Thestudentwouldbeabletoevolvenewtechniquesinwirelesscommunication
CO4:Thestudentswouldbeabletodemonstratethefeasibilityofusingmathematicalmodelsusing

simulationtools.

CO5:Thestudentwouldbeabletodemonstratetheimpactofthe greenengineeringsolutions inaglobal, economic, environmental and societal context.

TEXTBOOKS

1. EkramHossain,DongInKim,VijayK.Bhargava,"CooperativeCellularWireless Networks",Cambridge University Press, 2011.
2. EkramHossain,VijayK. Bhargava(Editor),GerhardP.Fettweis(Editor),"GreenRadio Communication Networks", Cambridge University Press, 2012.

REFERENCES

1. F.RichardYu,Yu,ZhangandVictorC.M.Leung"GreenCommunicationsand Networking", CRC press, 2012.
2. RamjeePrasadandShingoOhmori,DinaSimunic,"TowardsGreenICT",River Publishers,2010.
3. JinsongWu,SundeepRanganandHonggangZhang,"GreenCommunications:Theoretical Fundamentals, Algorithms and Applications", CRC Press, 2012.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	3	2	1	1	-	-	-	-	-	2	3	3	3
2	3	3	3	2	2	1	-	-	-	-	-	2	3	2	3
3	3	2	2	1	2	1	-	-	-	-	-	2	2	1	1
4	3	3	3	3	2	1	-	-	-	-	-	2	3	1	2
5	3	3	3	2	1	2	-	-	-	-	-	2	2	3	1
CO	**3**	**2.8**	**2.8**	**2**	**1.6**	**1.2**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**	**2**

1-low,2-medium,3 -high,'-'-nocorrelation

21160E72A **PRINCIPLESOFMANAGEMENT**

L	T	PC
3	0	03

COURSEOBJECTIVES:

- SketchtheEvolutionofManagement.
- Extractthefunctionsandprinciplesof management.
- Learntheapplicationoftheprinciplesinanorganization.
- StudythevariousHRrelatedactivities.
- Analyzethepositionofselfandcompanygoalstowardsbusiness.

UNITI INTRODUCTIONTOMANAGEMENTANDORGANIZATIONS **9**

DefinitionofManagement–ScienceorArt–ManagerVsEntrepreneur-typesofmanagers-managerial roles and skills - Evolution of Management -Scientific, human relations, system and contingencyapproaches- Types ofBusiness organization-Soleproprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment -Current trendsandissuesinManagement.

UNITII PLANNING **9**

Natureandpurposeofplanning-Planningprocess-Typesofplanning-Objectives-Setting objectives–Policies–Planningpremises–StrategicManagement–PlanningToolsand Techniques-Decisionmakingstepsandprocess.

UNITIII ORGANISING **9**

Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management,Career planning and management.

UNITIV DIRECTING **9**

Foundations of individual and group behaviour- Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication–Process of communication–Barrier in communication–Effective communication – Communication and IT.

UNITV CONTROLLING **9**

Systemandprocessofcontrolling–Budgetaryandnon-Budgetarycontroltechniques-Useof computersandITinManagementcontrol–Productivityproblemsandmanagement–Controland performance–Direct andpreventivecontrol–Reporting.

TOTAL:45PERIODS

COURSEOUTCOMES:

CO1:Uponcompletionofthecourse,studentswillbeabletohaveclearunderstandingof managerialfunctions like planning, organizing, staffing, leading & controlling.
CO2:Havesamebasicknowledgeoninternationalaspectofmanagement.
CO3:Abilitytounderstandmanagementconceptoforganizing. **CO4**:
Ability to understand management concept of directing.
CO5:Abilitytounderstandmanagementconceptof controlling.

TEXTBOOKS:

1. HaroldKoontzandHeinzWeihrich"Essentialsofmanagement"TataMcGrawHill,1998.
2. StephenP.RobbinsandMaryCoulter,"Management",PrenticeHall(India)Pvt.Ltd., 10thEdition, 2009.

REFERENCES:

1. RobertKreitnerandMamataMohapatra,"Management",Biztantra,2008.
2. StephenA. Robbinsand DavidA. DecenzoandMaryCoulter, "Fundamentalsof Management" Pearson Education, 7th Edition, 2011.
3. TripathyPCandReddyPN,"PrinciplesofManagement",TataMcgrawHill,1999.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3		-	-	-	1	-	-	-	-	-	-	2	1	1
2	-	1	1	-	-	-	-	-	-	-	-	-	2	1	-
3	1		-	2	-	-	1	-	2	-	1	1	-	-	2
4	-	1	1	1	2	-	-	1	2	-	-	-	1	1	1
5	1		-	-	1	1	-	-	-	3	-	1	1	-	1
CO	1.66	1	1	1.5	1.5	1	1	1	2	3	1	1	1.5	1	1.25

1-low,2-medium,3 -high,'-'-nocorrelation

21160E72B TOTALQUALITYMANAGEMENT L TPC 3003

COURSEOBJECTIVES:

- Teachtheneedforquality,itsevolution,basicconcepts,contributionofqualitygurus, TQMframework, Barriers and Benefits of TQM.
- ExplaintheTQMPrinciplesforapplication.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking andFMEA.
- Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniqueslike QFD, TPM, COQ and BPR.
- IllustrateandapplyQMSandEMSinanyorganization.

UNITI INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions ofproductand service quality -Definition of TQM-- Basic concepts of TQM- Gurus of TQM(Brief introduction) --TQMFramework-BarrierstoTQM-Benefitsof TQM.

UNITII TQMPRINCIPLES 9

Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning-CustomerSatisfaction-CustomerPerceptionofQuality,Feedback,Customercomplaints,Service Quality,KanoModelandCustomerretention-Employeeinvolvement-Motivation,Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal-- Continuous process improvement -Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership–Partnering, Supplier selection, Supplier Rating and Relationship development.

UNITIII TQMTOOLS&TECHNIQUESI 9

The seven traditional tools of quality- New management tools - Six-sigma Process Capability- Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: Design FMEA and Process FMEA.

UNITIV TQMTOOLS&TECHNIQUESII 9

Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts,improvementneeds-Performancemeasures-CostofQuality-BPR.

UNITV QUALITYMANAGEMENT SYSTEM 9

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation- Internal Audits-Registration-ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction–ISO 14000 Series Standards–Concepts of ISO 14001–Requirements of ISO 14001-Benefits of EMS.

TOTAL:45PERIODS

COURSEOUTCOMES:

CO1: AbilitytoapplyTQMconceptsinaselectedenterprise.
CO2: AbilitytoapplyTQMprinciplesinaselectedenterprise.
CO3: Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking andFMEA.
CO4: AbilitytounderstandTaguchi'sQualityLossFunction,PerformanceMeasuresandapplyQFD,TPM, COQ and BPR.
CO5: AbilitytoapplyQMSandEMSinanyorganization.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1		3										3	2		3
2						3						3		2	
3					3				3					2	3
4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
CO		2.5	3		3	2.6	3	2	3			3	2.5	2	3

1-low,2-medium,high,'-'-nocorrelation

TEXTBOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,MaryB.Sacre, HemantUrdhwaresheand RashmiUrdhwareshe, "Total Quality Management", Pearson Education Asia, RevisedThird Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. Joel.E.Ross,"TotalQualityManagement-TextandCases",Routledge.,2017.
2. Kiran.D.R,"Total Quality Management:Key concepts and case studies, Butterworth-Heinemann Ltd, 2016.

3. Oakland,J.S."TQM-TextwithCases",Butterworth-HeinemannLtd.,Oxford,Third Edition,2003.

Suganthi,LandAnandSamuel,"TotalQualityManagement",PrenticeHall(India)Pvt.Ltd.,2006.

21154OE74A	INDUSTRIALMANAGEMENT	L	T	P
		3	0	0

COURSEOBJECTIVES

- To study the basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions functionin professional organizations.
- Tostudytheplanning;organizingandstaffingfunctionsofmanagementinprofessional organization.
- Tostudytheleading;controllinganddecisionmakingfunctionsofmanagementin professional organization.
- Tolearntheorganizationaltheoryinprofessionalorganization.
- Tolearntheprinciplesofproductivityandmodernconceptsinmanagementinprofessional organization.

UNIT –I INTRODUCTIONTOMANAGEMENT

Management: Introduction; Definition and Functions – Approaches to thestudy of Management – Mintzberg's Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – PublicSectorVsPrivateSectorOrganization-BusinessEnvironment:Economic;Social;Political; Legal-TradeUnion:Definition;Functions;Merits&Demerits.

UNIT–II FUNCTIONSOFMANAGEMENT-I

Planning: Characteristics; Nature; Importance; Steps; Limitation; Planning Premises; Strategic Planning; Vision & Mission statement in Planning- Organizing:OrganizingTheory;Principles; Types; Departmentalization; Centralization and Decentralization; Authority & Responsibility – Staffing: Systems Approach; Recruiting and Selection Process; Human Resource Development (HRD) Concept and Design.

UNIT–III FUNCTIONSOFMANAGEMENT-II

Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake-Mounton, Reddin) - Communication: Purpose; Model; Barriers – Controlling: Process; Types; Levels; Guidelines; Audit (External, Internal, Merits); Preventive Control – Decision Making: Elements; Characteristics; Nature; Process; Classifications.

UNIT–IV ORGANIZATIONTHEORY

Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Maslow's hierarchy of needs theory; Herzberg's motivation-hygiene theory; McClelland's three needs motivation theory; Vroom's valence-expectancy theory - Change Management: Concept of Change; Lewin's Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.

UNIT –V PRODUCTIVITYANDMODERNTOPICS

Productivity: Concept; Measurements; Affecting Factors; Methods to Improve –Modern Topics (concept, feature/characteristics, procedure, merits and demerits): Business Process Reengineering (BPR); Benchmarking; SWOT/SWOC Analysis; Total Productive Maintenance; Enterprise Resource
Planning(ERP);ManagementofInformationSystems(MIS).

TOTAL:45PERIODS

COURSEOUTCOMES:

Attheendofthecoursethestudentswouldbeableto

CO1 Explain basic concepts of management; approaches to management; contributors to managementstudies;variousformsofbusinessorganizationandtradeunionsfunctionin professional organizations.

CO2 Discusstheplanning;organizingandstaffingfunctionsofmanagementinprofessional organization.

CO3 Applytheleading;controllinganddecisionmakingfunctionsofmanagementinprofessional organization.

CO4 Discusstheorganizationaltheoryinprofessionalorganization.

CO5 Applyprinciplesofproductivityandmodernconceptsinmanagement inprofessional organization.

TEXTBOOKS:

1. M.GovindarajanandS. Natarajan,"Principlesof Management",PrenticeHallofIndia, New Delhi, 2009.
2. Koontz.H.andWeihrich.H.,"Essentialsof Management:AnInternationalPerspective",8thEdition, Tata McGrawhill, New Delhi, 2010.

REFERENCES:

1. JosephJ,Massie,"EssentialsofManagement",4thEdition,PearsonEducation,1987.
2. Saxena,P.K.,"Principlesof Management:AModernApproach",GlobalIndia Publications, 2009.
3. S.Chandran,"OrganizationalBehaviours",VikasPublishingHousePvt.Ltd.,1994.
4. RichardL.Daft,"OrganizationTheoryandDesign",SouthWesternCollegePublishing,11thEditio n, 2012.
5. S.TrevisCerto,"ModernManagementConceptsandSkills",PearsonEducation,2018.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO3
1	1	1	1	1	1	3	2	3	2	3	1	3	1	1	1
2	1	1	1	1	1	3	2	3	2	3	1	3	1	1	1
3	1	1	1	1	1	3	2	3	2	3	1	3	1	1	1
4	1	1	1	1	1	3	2	3	2	3	1	3	1	1	1
5	1	1	1	1	1	3	2	3	2	3	1	3	1	1	1

1-low,2-medium,3 -high,'-'-nocorrelation

21152E56B WIRELESSSENSORNETWORKDESIGN LTPC

30 03

COURSEOBJECTIVES:

- Tounderstandthefundamentalsofwirelesssensornetwork
- TogainknowledgeontheMACandRoutingProtocolsofWSN
- Togetexposedto6LOWPANtechnology
- To acquire knowledge on the protocols required for developing real time applications using WSN and 6LOWPAN.

- Togainknowledgeabout operatingsystemrelatedtoWSNand6LOWPAN

UNITI INTRODUCTION 9

Principle of Wireless Sensor Network -Introduction to wireless sensor networks- Challenges, Comparison with ad hoc network, Node architecture and Network architecture, design principles, Service interfaces, Gateway, Short range radio communication standards-IEEE 802.15.4, Zigbee and Bluetooth. Physical layer and transceiver design considerations.

UNITII MACANDROUTING PROTOCOLS 9

MAC protocols –fundamentals, low duty cycle protocols and wakeup concepts, contention and Schedule-based protocols - SMAC, BMAC,TRAMA, Routing protocols – Requirements, Classification -SPIN,DirectedDiffusion,COUGAR,ACQUIRE,LEACH,PEGASIS.

UNITIII 6LOWPAN 9

6LoWPAN Architecture - protocol stack, Adaptation Layer, Link layers – Addressing, Routing - Mesh-Under - Route-Over, Header Compression - Stateless header compression - Context- based header compression,FragmentationandReassembly,Mobility–types,MobileIPv6,ProxyHomeAgent, ProxyMIPv6,NEMO-Routing-MANET,ROLL,Borderrouting.

UNITIV APPLICATION 9

Publish/subscribe, Web service paradigms, Common Protocols -Web service protocols,MQ telemetry transport for sensor networks (MQTT-S), ZigBee compact application protocol (CAP),Service discovery, Simple network management protocol (SNMP), Real-time transport and sessions, Industry-Specific protocols.

UNITV TOOLS 9

TinyOS – Introduction, NesC, Interfaces, modules, configuration, Programming in TinyOS using NesC, TOSSIM, Contiki – Structure, Communication Stack, Simulation environment – Cooja simulator, Programming

TOTAL: 45 PERIODS

COURSEOUTCOMES:

CO1: To be able to design solutions for WSNs applications**CO2**:TobeabletodevelopefficientMACandRoutingPr otocols **CO3**: To be able to design solutions for 6LOWPAN applications
CO4:Tobeabletodevelopefficientlayeredprotocolsin6LOWPAN
CO5:TobeabletouseTinyOSandContikiOSinWSNsand6LOWPANapplications

REFERENCES:

1. HolgerKarl,Andreaswillig,"ProtocolandArchitectureforWirelessSensorNetworks",John Wiley Publication, 2006.
2. AnnaForster,"IntroductiontoWirelessSensorNetworks",Wiley,2017.
3. ZachShelbySensinode and CarstenBormann, "6LoWPAN:TheWirelessEmbedded Internet" John Wiley and Sons, Ltd, Publication, 2009.
4. PhilipLevis,"TinyOSProgramming",2006-www.tinyos.net.
5. TheContikiOperatingSystem.http://www.sics.se/contiki.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	2	2	2	1	-	-	-	-	2	2	3	1	1
2	3	3	2	2	2	1	-	-	-	-	-	2	3	2	2
3	3	3	3	2	2	1	-	-	-	-	-	3	3	2	2
4	3	3	3	3	2	2	-	-	-	-	-	2	2	1	2
5	2	-	1	1	3	2	-	-	-	-	-	2	2	2	1
CO	**2.8**	**3**	**2.2**	**2**	**2.2**	**1.4**	**-**	**-**	**-**	**-**	**2**	**2.2**	**2.6**	**1.6**	**1.6**

1-low,2-medium,3 -high,'-'-nocorrelation

21152E66C **MEMSDESIGN** **L T PC**
20 23

COURSEOBJECTIVES:

- Tounderstandthebasicelectricalandmechanicalconceptsof MEMSdesign
- Tounderstandthedesignaspectsofelectrostaticsensorsandactuators
- Tounderstandthedesignaspectsofthermalsensorsandactuators
- Tounderstandthedesignaspectsofpiezoelectricsensorsandactuators
- Tounderstandthedesignaspectsofmagneticsensorsandactuators

UNITI ESSENTIALELECTRIC ANDMECHANICALCONCEPTS 6

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

UNITII ELECTROSTATICSESNINGANDACTUATION 6

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.

UNITIII THERMALSENSINGAND ACTUATION 6

Fundamentals of thermal transfer, Sensors and actuators based on thermal expansion, Themal couples, Thermal resistors, Applications- Infrared sensors, flow sensors, Inertial sensors, other sensors

UNITIV PIEZOELECTRICSENSINGANDACTUATION 6

Mathematicaldescriptionofpiezoelectriceffects,Cantileverpiezoelectricactuatormodel,propertiesof piezoelectric materials –Quartz, PZT,PVDF, ZnO , Applications – Acoustic sensors, Tactilesensors

UNITV MAGNETICSENSINGANDACTUATION 6

Concepts and principles- magnetization and nomenclatures, principles of micromagnetic actuators, fabricationofmicromagneticcomponents-deposition,designandfabricationofmagneticcoil,MEMS magnetic actuators

30PERIODS

PRACTICALEXERCISES: **30PERIODS**

1. Designandsimulationofpiezoelectriccantilever
2. Designandsimulationofthermocouples
3. Designandsimulationofcombdriveactuators

COURSEOUTCOMES:

Uponcompletionofthiscourse,thestudentswillbeableto

CO1:UnderstandthebasicsofMEMSdesignaspects.

CO2: Apply the knowledge in the development of electro static sensors and actuators.

CO3:Applytheknowledgeinthedevelopmentofthermalsensorsandactuators. **CO4**: Apply the knowledge in the development of piezoelectric sensors and actuators.**CO5**: Apply the knowledge in the development of magnetic sensors and actuators.

TOTAL:60PERIODS

TEXTBOOKS

1.ChangLiu,"FoundationsofMEMS",PearsoneducationIndialimited,2006

REFERENCES

1. MurtyB.S,ShankarP,RajB,Rath,B.B,MurdayJ,TextbookofNanoscienceand Nanotechnology, Springer publishing, 2013.
2. SergeyEdwardLyshevski,"MEMSandNEMS:Systems,Devices,andStructures",CRCPress, 2002
3. TaiRanHsu,MEMSandMicrosystemsDesignandManufacture,TataMcgrawHill,2002
4. VinodKumarKhannaNanosensors:Physical,Chemical,andBiological,CRCpress,2012.

2. CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO3
1	3	3	2	2	2	1	-	-	-	-	2	2	3	1	1
2	3	3	2	2	2	1	-	-	-	-	-	2	3	2	2
3	3	3	3	2	2	1	-	-	-	-	-	3	3	2	2
4	3	3	3	3	2	2	-	-	-	-	-	2	2	1	2
5	2	-	1	1	3	2	-	-	-	-	-	2	2	2	1
CO	**2.8**	**3**	**2.2**	**2**	**2.2**	**1.4**	**-**	**-**	**-**	**-**	**2**	**2.2**	**2.6**	**1.6**	**1.6**

1-low,2-medium,3 -high,'-'-nocorrelation

21152E65C FUNDAMENTALSOFNANOELECTRONICS LTP C

2023

COURSEOBJECTIVES:

- Tounderstandtheconceptsofnanoelectronicsandquantumelectronics
- Tounderstandtheconceptsofnanoelectronicdevices,transistors,tunnelingdevicesand superconducting devices
- Tounderstandthebasicsofnanotubedevices

UNITI INTRODUCTIONTONANOELECTRONICS 6

Scaling to nano - Light as a wave and particle- Electrons as waves and particles- origin of quantum mechanics - General postulates of quantum mechanics - Time independent Schrodinger wave equation- Electron confinement - Quantum dots, wires and well-Spin and angular momentum

UNITII QUANTUMELECTRONICS 6

Quantumelectronicdevices-ShortchannelMOStransistor-Splitgatetransistor-Electronwave

transistor - Electron wave transistor - Electron spin transistor - Quantum cellular automata- Quantum dot array, Quantum memory.

UNITIII NANOELECTRONICTRANSISTORS 6

Coulomb blockade - Coulomb blockade in Nano capacitors - Coulomb blockade in tunnel junctions - Single electron transistors, Semiconductor nanowire FETs and SETs, Molecular SETsand molecular electronics - Memory cell.

UNITIV NANOELECTRONICTUNNELING ANDSUPERCONDUCTINGDEVICES 6

Tunnel effect -Tunneling element -Tunneling diode - Resonant tunneling diode - Three terminal resonant tunneling devices- Superconducting switching devices- Cryotron- Josephson tunneling device.

UNITV NANOTUBESANDNANOSTRUCTUREDEVICES 6

Carbon Nanotube - Fullerenes - Types of nanotubes – Formation of nanotubes –Assemblies – Purificationofcarbonnanotubes-Electronicproperties-Synthesisofcarbonnanotubes-Carbon nanotubeinterconnects-CarbonnanotubeFETsandSETs-Nanotubeformemoryapplications- Nano structures and nano structured devices.

30PERIODS

PRACTICALEXERCISES: 30PERIODS

AD/AnyotherrelevantsoftwarebasedSimulations

1. FieldEffectTransistors
2. SingleElectronTransistors
3. Tunnelingdevices

COURSEOUTCOMES:

Uponcompletionofthiscourse,thestudentswillbeableto

CO1:Understandthebasicsofnanoelectronicsincludingquantumwires,dotsandwells

CO2:Usethemechanismbehindquantumelectronicdevices

CO3:Analyzethekeyperformanceaspectsoftunnelingandsuperconductingnanoelectronic devices

CO4:Applytheknowledgeinthedevelopmentofnanotubesandnanostructuredevices

TOTAL:60PERIODS

TEXTBOOKS

1. Hanson,FundamentalsofNanoelectronics,Pearsoneducation,2009.

REFERENCES

1. JanDienstuhl,KarlGoser,andPeterGlösekötter,NanoelectronicsandNanosystems:From Transistors to Molecular and Quantum Devices, Springer-Verlag, 2004.

2. MirceaDragomanandDanielaDragoman,Nanoelectronics:PrinciplesandDevices,Artech House, 2009.

3. RobertPuers,LivioBaldi, MarcelVandeVoordeandSebastiaanE.VanNooten, Nanoelectronics: Materials, Devices, Applications, Wiley, 2017.

4. BrajeshKumarKaushik,Nanoelectronics:Devices,CircuitsandSystems,Elsevierscience,

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	2	2	2	1	-	-	-	-	-	2	2	1	1
2	3	3	3	2	2	2	-	-	-	-	-	2	3	1	1
3	3	3	3	2	2	2	-	-	-	-	-	2	3	1	1
4	3	3	2	2	2	2	-	-	-	-	-	2	3	1	1
5	3	3	3	3	3	3	-	-	-	-	-	2	3	1	2
CO	**3**	**3**	**2.6**	**2.2**	**2.2**	**2**	-	-	-	-	-	**2**	**2.8**	**1**	**1.2**

1-low,2-medium,3 -high,'-'-nocorrelation

21155OE74A REMOTESENSING L TPC
3003

UNITI REMOTESENSINGANDELECTROMAGNETICRADIATION 9

Definition-componentsofRS-HistoryofRemoteSensing-MeritsanddemeritsofDataCollation between conventional and remote sensing methods - Electromagnetic Spectrum – Radiation principles - Wave theory, Planck's law, Wien's Displacement Law, Stefan's Boltzmann law, Kirchoff's law- Radiation sources: active & passive – Radiation Quantities.

UNITII EMRINTERACTIONWITHATMOSPHEREANDEARTHMATERIAL 9

Standardatmosphericprofile-mainatmosphericregionsanditscharacteristics-interactionof radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows – Energy balance equation–Specular and diffuse reflectors–Spectral reflectance& emittance-Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation,soilandwater-solid surfacescattering inmicrowave region.

UNITIII ORBITSANDPLATFORMS 9

Motions of planets and satellites – Newton 's law of gravitation – Gravitational field and potential - Escape velocity - Kepler 's law of planetary motion - Orbit elements and types–Orbital perturbationsandmaneuvers-Typesofremotesensingplatforms-Groundbased,Airborne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Legrange Orbit

UNITIV SENSING TECHNIQUES 9

Classificationofremotesensors-Resolutionconcept:spatial,spectral,radiometricandtemporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors – microwavesensors – Calibration ofsensors – HighResolutionSensors- LIDAR, UAV – Orbitalandsensorcharacteristicsofliveindianearthobservationsatellites.

UNITV DATAPRODUCTSANDINTERPRETATION 9

Photographic and digital products – Types, levels and open-source satellite data products – selection and procurement of data – Visual interpretation: basic elements and interpretation keys - Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification.

TOTAL:45PERIODS

TEXTBOOKS:

1. ThomasM.Lillesand,RalphW.KieferandJonathanW.Chipman,RemoteSensingand Image interpretation, John Wiley and Sons, Inc., New York, 2015.
2. GeorgeJosephandCJeganathan,FundamentalsofRemoteSensing,ThirdEdition Universities Press (India) Private limited, Hyderabad, 2018.

REFERENCES:

1. Stanley A Morain; Amelia MBudge; Michael S Renslow. Manual of Remote Sensing. Vol. I, AmericanSocietyforPhotogrammetry andRemote Sensing, Virginia, USA,2019, 4th edition
2. Verbyla, David, Satellite Remote Sensing of NaturalResources. CRCPress,2022first edition.
3. PaulCurranP.J.PrinciplesofRemoteSensingLongman,RLBS,1996.
4. Introduction to Physics and Techniques of Remote Sensing, Charles Elachi and Jacob Van Zyl, 2021 Edition3, Wiley Publication.
5. BasudebBhatta,RemoteSensingandGIS,OxfordUniversityPress,2020thirdedition.

COURSEOUTCOMES

CO1: Tounderstandtheprinciplesofelectromagneticradiation.
CO2:Tolearntheatmosphericradiationinteractions.
CO3:Tostudythelawsofplanetarymotion.

CO4:Toclassifythedifferenttypesofresolution.
CO5:Toknowtheconceptsofdigitalinterpretation.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	2	2	3	1	3	2	-	-	-	-	1	3	3	3
2	3	2	2	3	1	3	2	-	-	-	-	1	3	3	3
3	1	2	1	3	2	3	2	-	-	-	-	1	3	3	3
4	1	2	3	1	3	3	2	-	-	-	-	1	3	3	3
5	2	2	2	-	3	3	2	-	-	-	-	1	3	3	3
CO	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	3	3	3

1-low,2-medium,3-high,'-'-nocorrelation

21152E65BC **WEARABLEDEVICES** **L TPC**
30 03

COURSEOBJECTIVES:

Thestudentshouldbemadeto:

- Toknowthehardwarerequirementofwearable systems
- Tounderstandthecommunicationandsecurityaspectsinthewearabledevices
- Toknowtheapplicationsof wearabledevicesinthefieldofmedicine

UNITI INTRODUCTIONTOWEARABLESYSTEMSANDSENSORS 9

WearableSystems-Introduction,NeedforWearableSystems,DrawbacksofConventional

Systems for Wearable Monitoring, Applications of Wearable Systems, TypesofWearableSystems, Components of wearable Systems. Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Impedance plethysmography, Wearable ground reaction force sensor.

UNIT II SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES 9

Wearability issues -physicalshape and placement of sensor, Technicalchallenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energyharvests,Thermopiles.

UNITIII WIRELESSHEALTHSYSTEMS 9

Needfor wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture–Introduction, Wireless communication Techniques.

UNITIV SMARTTEXTILE 9

Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques-Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, Conductive Inks.Case study-smart fabric for monitoring biological parameters - ECG, respiration.

UNITV APPLICATIONSOFWEARABLESYSTEMS 9

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.

COURSEOUTCOMES:

Onsuccessfulcompletionofthiscourse,thestudentwillbeableto CO1:

Describe the concepts of wearable system.

CO2:Explaintheenergyharvestingsinwearabledevice.

CO3:UsetheconceptsofBANinhealthcare. CO4:

Illustrate the concept of smart textile

CO5:Comparethevariouswearabledevicesinhealthcaresystem

TEXTBOOKS

TOTAL:45PERIODS

1. AnnalisaBonfigloandDaniloDeRossi,WearableMonitoringSystems,Springer,2011
2. ZhangandYuan-Ting,WearableMedicalSensorsandSystems,Springer, 2013
3. EdwardSazonovandMichealRNeuman,WearableSensors:
Fundamentals,Implementation and Applications,
Elsevier, 2014
4. Mehmet R. Yuce and JamilY.Khan, Wireless Body Area Networks Technology,
Implementationapplications,PanStanfordPublishingPte.Ltd,Singapore,2012

REFERENCES

1. Sandeep K.S, Gupta, Tridib Mukherjee and Krishna Kumar
Venkatasubramanian,BodyAreaNetworksSafety,Security,and
Sustainability, Cambridge University Press, 2013.
2. Guang-ZhongYang,BodySensorNetworks,Springer,2006.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	**3**	**2**	**1**	**1**	**2**			**1**					**1**		**1**
2	**3**	**2**	**1**	**1**	**2**			**1**					**1**		**1**
3	**3**	**2**	**1**	**1**	**2**			**1**					**1**		**1**
4	**3**	**2**	**1**	**1**	**2**			**1**					**1**		**1**
5	**3**	**2**	**1**	**1**	**2**			**1**					**1**		**1**
CO	**3**	**2**	**1**	**1**	**2**			**1**					**1**		**1**

1-low,2-medium,3-high,'-'-nocorrelation