FRANCIS XAVIER ENGINEERING COLLEGE
AN AUTONOMOUS INSTITUTION
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/francisxavierengineeringcollege

CURRICULUM AND SYLLABI
Choice Based Credit System
Regulations 2019

B.E – Electronics and Communication Engineering

Department Vision

To develop Electronics and Communication Engineers by permeating with proficient morals, to be recognized as an adroit engineer worldwide and to strive endlessly for excellence to meet the confronts of our modern society by equipping them with changing technologies, professionalism, creativity research, employability, analytical, practical skills and to excel as a successful entrepreneur.

Department Mission

1. To provide excellence through effective and qualitative teaching- learning process that equips the students with adequate knowledge and to transform the students' lives by nurturing the human values to serve as a precious resource for Electronics and Communication Engineering and nation.
2. To enhance the problem solving and lifelong learning skills that will enable by edifying the students to pursue higher studies and career in research.
3. To create students with effective communication skills, the abilities to lead ethical values in order to fulfill the social needs.

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 **Acquiring Quality Education:** To impart adequate and quality education on all aspects of Engineering and also to inculcate a spirit of lifelong learning which would spark an interest for Higher studies, cutting Edge research and Entrepreneurship.

PEO 2 **Developing Multiskills:** To develop powerful and confident Discerning, Decision making and communication skills with amicable team spirit.

PEO 3 **Professionalism:** To equip the Graduates with dynamic Leadership skills fuelled by sense of social responsibility and to adopt ethical and economic solutions.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

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

PO_b **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.

PO_c **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.

PO_d **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.

PO_e **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.

PO_f **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO_g **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.

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

PO_i **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO_j **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.

PO_k **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO_l **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.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO_1 The ability to analyze, design and implement application specific electronic system for complex engineering problems for analog, digital domain, communications and signal processing applications by applying the knowledge of basic sciences, engineering mathematics and engineering fundamentals.

PSO_2 The ability to adapt for rapid changes in tools and technology with an understanding of societal and ecological issues relevant to professional engineering practice through life-long learning.

PSO_3 Excellent adaptability to function in multi-disciplinary work environment, good interpersonal skills as a leader in a team in appreciation of professional ethics and societal responsibilities.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)	**PROGRAMME OUTCOMES (POs)**											
	a	**b**	**c**	**d**	**e**	**F**	**g**	**h**	**i**	**j**	**k**	**l**
PEO 1				3				1	1	2	2	1
PEO 2	3	3	1	1								2
PEO 3			3			1						3

1→Low 2→Medium 3→High

MAPPING OF PROGRAMME SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Outcomes and the Programme outcomes is given in the following Table

PROGRAMME SPECIFIC OBJECTIVES (PSO)	**PROGRAMME OUTCOMES (POs)**											
	a	**b**	**c**	**d**	**e**	**f**	**G**	**h**	**i**	**j**	**k**	**l**
PSO_a	3	2			3				2	2		
PSO_b				3			3	3			3	
PSO_b												

1→Low 2→Medium 3→High

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

REGULATIONS 2019

CHOICE BASED CREDIT SYSTEM

SUMMARY OF CREDIT DISTRIBUTION

S. No	Category	Credits Per Semester								Total Credit	Credits in %
		I	II	III	IV	V	VI	VII	VIII		
1	**HSS**	3	2					3		**8**	4.82%
2	**BS**	12	4	4	4					**24**	14.46%
3	**ES**	8	11	5						**24**	14.46%
4	**PC**			13	16	13	8	10		**60**	36.14%
5	**PE**					6	9	6	3	**24**	14.46%
6	**OE**					3	3	3	3	**12**	7.23%
7	**EEC**						4		10	**14**	8.43%
Total		**23**	**17**	**22**	**20**	**22**	**24**	**22**	**16**	**166**	100%

HSS – Humanities and Social Sciences

BS – Basic Sciences

ES – Engineering Sciences

PC – Professional Core

PE – Professional Elective

OE – Open Elective

EEC – Employability Enhancement Course

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

REGULATIONS 2019

CHOICE BASED CREDIT SYSTEM

I – VIII SEMESTERS CURRICULUM AND SYLLABI

FIRST SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19GE1101	English for Professional Communication	HSS	3	0	0	3	3
19GE1201	Matrices and Calculus	BS	3	1	0	4	4
19GE1303	Physics For Electronics Engineering	BS	3	0	0	3	3
19GE1403	Engineering Chemistry	BS	3	0	0	3	3
19CS1501	Python Programming	ES	3	0	0	3	3
19ME1502	Engineering Graphics	ES	1	0	4	3	4
19EC1311	Physics and Chemistry Laboratory	BS	0	0	4	2	4
19EC1511	Python Programming Laboratory	ES	0	0	4	2	4
		TOTAL	**16**	**1**	**12**	**23**	**28**

SECOND SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19GE2101	Technical Communication	HSS	2	0	0	2	2
19MA2201	Vector Calculus and Transforms	BS	3	1	0	4	4
19CS2503	C Programming	ES	3	0	0	3	3
19EC2502	Basic Electrical and Instrumentation Engineering	ES	3	1	0	4	4
19EC2511	Electrical and Electronics Practices Laboratory	ES	0	0	4	2	4
19EC2512	C Programming Laboratory	ES	0	0	4	2	4
19GE2M02	Fundamentals Of Computational Biology	BS	2	0	0	0	2
		TOTAL	**13**	**2**	**8**	**17**	**23**

THIRD SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19MA3201	Transforms and Partial Differential Equations	BS	3	1	0	4	4
19EC3501	Fundamentals of Data Structure and OOPS	ES	3	0	0	3	3
19EC3601	Electronic Devices & Circuit Analysis	PC	3	0	0	3	3
19EC3602	Digital Electronics	PC	3	0	0	3	3
19EC3603	Signals and Systems	PC	3	0	0	3	3
19EC3511	Data Structure and OOPS Laboratory	ES	3	0	0	2	3
19EC3611	Electronic Devices and Circuit Laboratory	PC	0	0	4	2	4
19EC3612	Digital Electronics Laboratory	PC	0	0	4	2	4
19GE3M01	Communication And Soft Skills	EEC	0	0	2	0	2
		TOTAL	**18**	**1**	**10**	**22**	**29**

FOURTH SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19MA4201	Probability and Random Process	BS	3	1	0	4	4
19EC4601	Analog and Digital Communication	PC	3	0	0	3	3
19EC4602	Analog Electronics	PC	3	0	0	3	3
19EC4603	Electromagnetic fields	PC	3	0	0	3	3
19EC4604	Discrete Time Signal Processing	PC	3	0	0	3	3
19GE4M01	Environmental Science and Engineering	BS	2	0	0	0	2
19EC4611	Analog and Digital Communication Laboratory	PC	0	0	4	2	4
19EC4612	Analog Electronics Laboratory	PC	0	0	4	2	4
		TOTAL	**17**	**1**	**8**	**20**	**26**

FIFTH SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19EC5601	Control Systems	PC	3	0	0	3	3
19EC5602	Linear Integrated Circuits	PC	3	0	0	3	3
19EC5603	Microprocessor and Microcontroller Programming and Interfacing	PC	3	0	0	3	3
	Professional Elective – I	PE	3	0	0	3	3
	Professional Elective – II	PE	3	0	0	3	3
	Open Elective I	OE	3	0	0	3	3
19EC5611	Linear Integrated Circuits Laboratory	PC	0	0	4	2	4
19EC5612	Microprocessor and Microcontroller Laboratory	PC	0	0	4	2	4
19GE5M01	Interpersonal Skills Essentials	EEC	0	0	2	0	2
19GE5M02	Professional Ethics in Engineering	HSS	2	0	0	0	2
		TOTAL	**20**	**0**	**1**	**22**	**30**

SIXTH SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19EC6601	Transmission Lines and Antennas	PC	3	0	0	3	3
19EC6602	VLSI System Design	PC	3	0	0	3	3
	Professional Elective – III	PE	3	0	0	3	3
	Professional Elective – IV	PE	3	0	0	3	3

	Professional Elective – V	PE	3	0	0	3	3
	Open Elective II	OE	3	0	0	3	3
19EC6911	Internship and Mini Project	EEC	0	0	4	2	4
19EC6912	Interpersonal Skills –Listening and Speaking	EEC	0	0	4	2	4
19EC6613	VLSI System Design Laboratory	PC	0	0	4	2	4
19GE6M01	Life Skills Aptitude	EEC	2	0	0	0	2
19GE6M02	Intellectual Property Rights	HSS	2	0	0	0	2
		TOTAL	**22**	**0**	**12**	**24**	**34**

SEVENTH SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19EC7101	Principles of Management	HSS	3	0	0	3	3
19EC7601	Microwave Engineering and Measurements	PC	3	0	0	3	3
19EC7602	Wireless Communication Systems	PC	3	0	0	3	3
	Professional Elective – VI	PE	3	0	0	3	3
	Professional Elective – VII	PE	3	0	0	3	3
	Open Elective III	OE	3	0	0	3	3
19EC7611	Advanced Communication Laboratory	PC	0	0	4	2	4
19EC7612	Embedded And Internet Of Things Laboratory	PC	0	0	4	2	4
		TOTAL	**18**	**0**	**8**	**22**	**26**

EIGTH SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
	Professional Elective – VIII	PE	3	0	0	3	3
	Open Elective IV	PE	3	0	0	3	3
19EC8911	Project Work	EEC	0	0	20	10	20
		TOTAL	**6**	**0**	**20**	**16**	**26**

TOTAL NO. OF CREDITS: 166 (Regular) / 126 (Lateral)

PROFESSIONAL ELECTIVES						
Code No.	**Course**	**L**	**T**	**P**	**C**	**H**
SEMESTER V- PROFESSIONAL ELECTIVE-I						
19EC5701	Medical Electronics	3	0	0	3	3
19EC5702	Communication Networks	3	0	0	3	3
19EC5703	Web Technology	3	0	0	3	3
19EC5704	Real Time System Analysis and Design	3	0	0	3	3
19EC5705	Computational Intelligence	3	0	0	3	3
SEMESTER V- PROFESSIONAL ELECTIVE-II						
19EC5706	Speech and Analytical processing	3	0	0	3	3
19EC5707	Avionics	3	0	0	3	3
19EC5708	Solid State Devices	3	0	0	3	3
19EC5709	Information Theory And Coding Techniques	3	0	0	3	3
19EC5710	Computer Architecture And Organization	3	0	0	3	3
SEMESTER VI- PROFESSIONAL ELECTIVE-III						
19EC6701	Wireless Networks	3	0	0	3	3
19EC6702	Measurement and Instrumentation	3	0	0	3	3
19EC6703	Advanced Microprocessors and Microcontrollers	3	0	0	3	3
19EC6704	Deep Learning	3	0	0	3	3
19EC6705	Network Cryptographic Techniques	3	0	0	3	3
SEMESTER VI- PROFESSIONAL ELECTIVE-IV						
19EC6706	DSP Architecture	3	0	0	3	3
19EC6707	Ad hoc and Wireless Sensor Networks	3	0	0	3	3
19EC6708	Electronic Testing and Packaging	3	0	0	3	3
19EC6709	Sensors and Transducers	3	0	0	3	3
19EC6710	Satellite Communication	3	0	0	3	3
SEMESTER VI- PROFESSIONAL ELECTIVE-V						
19EC6711	Embedded System Design	3	0	0	3	3
19EC6712	Fibre optic Networks	3	0	0	3	3
19EC6713	4G & 5G Networks	3	0	0	3	3
19EC6714	OFDM Systems	3	0	0	3	3
19EC6715	Radar and Navigational Aids	3	0	0	3	3

PROFESSIONAL ELECTIVES						
Code No.	**Course**	**L**	**T**	**P**	**C**	**H**
SEMESTER VII- PROFESSIONAL ELECTIVE-VI						
19EC7701	Opto Electronic Devices	3	0	0	3	3
19EC7702	CMOS Analog IC Design	3	0	0	3	3
19EC7703	Digital Image Processing and Pattern Recognition	3	0	0	3	3
19EC7704	Cognitive Radio	3	0	0	3	3
19EC7705	Blockchain Principles	3	0	0	3	3
SEMESTER VII- PROFESSIONAL ELECTIVE-VII						
19EC7706	Internet of Things	3	0	0	3	3
19EC7707	Advanced Digital Signal Processing	3	0	0	3	3
19EC7708	Lowpower SOC	3	0	0	3	3
19EC7709	MEMS and NEMS	3	0	0	3	3
19EC7710	High Speed Communication Networks	3	0	0	3	3
SEMESTER VIII- PROFESSIONAL ELECTIVE-VIII						
19EC8701	Multimedia Compression And Communication	3	0	0	3	3
19EC8702	Telecommunication And Switching Network Systems	3	0	0	3	3
19EC8703	Mobile Communications	3	0	0	3	3
19EC8704	Embedded Networks	3	0	0	3	3
19EC8705	ASIC Design	3	0	0	3	3

OPEN ELECTIVE						
Code No.	**Course**	**L**	**T**	**P**	**C**	**H**
SEMESTER V						
19EC5801	Digital Electronics Fundamentals	3	0	0	3	3
19EC5802	Basic VLSI Design	3	0	0	3	3
19EC5803	Introduction to Signals And Systems	3	0	0	3	3
19EC5804	Communication Engineering	3	0	0	3	3
SEMESTER VI						
19EC6801	Introduction to Microprocessor and Microcontroller	3	0	0	3	3
19EC6802	TV and Video Engineering	3	0	0	3	3
19EC6803	Basics of Biomedical Engineering	3	0	0	3	3
19EC6804	Principles Of Electronic Communication	3	0	0	3	3
SEMESTER VII						
19EC7801	Digital Audio Engineering	3	0	0	3	3
19EC7802	Introduction to Mobile Communication	3	0	0	3	3
19EC7803	Data converters	3	0	0	3	3
19EC7804	Telemedicine	3	0	0	3	3
SEMESTER VIII						
19EC8801	Electronic Materials	3	0	0	3	3
19EC8802	Real Time Embedded System	3	0	0	3	3
19EC8803	Image Processing Essentials	3	0	0	3	3
19EC8804	Robotic Vision and Automation	3	0	0	3	3

VALUE ADDED COURSES					
19EC4V01	Embedded System Design Using Aurdino and Rasberry Pi	3	0	0	3
19EC5V01	Internet of Things	3	0	0	3
19EC6V01	MATLAB Programming	3	0	0	3
19EC7V01	Embedded C Programming	3	0	0	3
MANDATORY COURSES (NON CREDIT COURSES)					
	Induction Training (At the start of First Year)	-	-	-	-
19GE2M02	Fundamentals of Computational Biology	2	0	0	2
19GE3M01	Communication and Soft Skills	2	0	0	2
19GE4M01	Environmental Science and Engineering	2	0	0	2
19GE5M01	Interpersonal Skills Essentials	2	0	0	0
19GE5M02	Professional Ethics in Engineering	2	0	0	2
19GE6M01	Life Skills Aptitude	2	0	0	2
19GE6M02	Intellectual Property Rights	2	0	0	2
	Online Course				1
	In plant Training				1

Note: The updated list of open elective, Value added courses, mandatory courses will be changed time to time

FIRST SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19GE1101	English for Professional Communication	HSS	3	0	0	3	3
19GE1201	Matrices and Calculus	BS	3	1	0	4	4
19GE1303	Physics For Electronics Engineering	BS	3	0	0	3	3
19GE1403	Engineering Chemistry	BS	3	0	0	3	3
19CS1501	Python Programming	ES	3	0	0	3	3
19ME1502	Engineering Graphics	ES	1	0	4	3	4
19EC1311	Physics and Chemistry Laboratory	BS	0	0	4	2	4
19EC1511	Python Programming Laboratory	ES	0	0	4	2	4
		TOTAL	**16**	**1**	**12**	**23**	**28**

19GE1101 ENGLISH FOR PROFESSIONAL COMMUNICATION L T P C
3 0 0 3

OBJECTIVES:

- Widen the basic reading and writing skills of first year Engineering and Technology students.
- To develop listening skills, and enhance the ability of comprehending.
- To hone speaking skills and speak confidently in real life situations.
- To master vocabulary both General and Technical.
- To draft letters and write abstracts.

PRE-REQUISITE:

- The pre-requisite knowledge required by the Students to study this Course is basic knowledge in English Language.

UNIT I SHARING INFORMATION 9

Reading- short comprehension passages – day-to-day conversation; Writing- reframing sentences from the jumbled words – creating coherence; Listening- listening to TED talks, texts, short formal and informal conversations; Speaking- introducing oneself to the audience giving importance to characteristics, strengths and weaknesses; Language development- Framing Yes/No questions, Question tag, Vocabulary development - formation of words– verb – Noun – Adjectives, standard abbreviations

UNIT II READING AND WRITING I 9

Reading – extensive reading - short narratives and news items from newspapers; Writing – sentence structure - short passages on the working principle of any gadget, describing an electronic/ mechanical gadget, importance of punctuation, organizing paragraphs; Listening- listening to telephonic conversations and lectures by native speakers; Speaking- introducing a device to the audience – specifications, descriptions, merits and demerits. Language development – framing 'Wh' Questions, writing a complete sentence using the fragments given; Vocabulary development- prefix and suffix.

UNIT III READING AND WRITING II 9

Reading- comprehensive reading – technical passages; Writing - rearranging jumbled sentences, writing short essays; Listening – listening to short English episodes and filling in the blanks – cloze test; Speaking- asking for opinions using do/does; Language development – Direct Speech and Indirect Speech – Framing Indirect Questions ; Vocabulary development – select Single Word Substitute, Prepositions, Articles

UNIT IV DEVELOPING LETTER WRITING SKILLS 9

Reading- comprehending Articles from Magazines, understanding the writing style ; Writing- letter writing – Job Application – Resume; Listening- listening to dialogues or conversations and completing exercises based on them; Speaking - Language development- Tenses- simple present - simple past- present continuous and past continuous- Vocabulary development- Synonyms, Antonyms, Phrasal Verbs.

UNIT V EXTENDED WRITING 9

Reading- comprehending Articles from Journals ; Writing- writing Abstracts – developing an outline - identifying main and subordinate ideas - dialogue writing – enquiring about a product ; Listening – listening to Technical Talks – Note Making ; Speaking – participating in conversations- short Group Discussions – phrases used during discussions ; Language development - modal verbs – present / past perfect tense ; Vocabulary development - Fixed and Semi-Fixed Expressions.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Butterfield, Jeff. Soft Skills for Everyone. Cengage Learning: New Delhi, 2017.
2. Richards C. Jack and David Bohleke. Speak Now 3. Oxford Press 2012

REFERENCE BOOK(S):

1. Bailey, Stephen. Academic Writing: A Practical guide for Students. New York: Rutledge, 2011.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.

WEB RESOURCE(S):

1. Learn Engineering https://www.youtube.com/user/LearnEngineeringTeam/videos?view=0&sort=p&shelf_id=14
2. English Speaking Practice https://play.google.com/store/apps/details?id=com.talkenglish.practice
3. BBC Learning English http://www.bbc.co.uk/learningenglish/

COURSE OUTCOME(S):

CO101. 1 Listen and comprehend lectures and talks in their area of specialization successfully.
CO101. 2 Read technical texts and write area- specific texts effortlessly.
CO101. 3 Speak appropriately and effectively in varied formal and informal contexts.
CO101. 4 Write winning job applications and good abstracts.
CO101. 5 Write abstracts and technical articles.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101				2			3		3	3	2	2
CO102				2			3		2	3	3	2
CO103				1			1		1	3	3	1
CO104				2			2		2	2	3	3
CO105				3			3		3	3	3	3

1→Low 2→Medium 3→High

19GE1201 MATRICES AND CALCULUS L T P C
3 1 0 4

OBJECTIVES:

- To apply advanced matrix knowledge to Engineering problems
- To equip themselves familiar with the functions of several variables
- To familiarize with the applications of differential equations.
- To improve their ability in solving geometrical applications of differential calculus problems.
- To have knowledge in simple integrals.

PRE-REQUISITE:

- To study this course are basic knowledge about matrices, Differentiation and Integration.

UNIT I MATRICES 12

Characteristic equation – Eigen values and Eigen vectors of a symmetric and non-symmetric matrices – Properties of Eigen values of a real matrix - Cayley _ Hamilton theorem and applications of Cayley Hamilton theorem.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12

Function of two variables – Partial derivatives– Taylor's expansion of two variables – Maxima and Minima without constraints –Jacobians and its properties – Euler's theorem for homogeneous function.

UNIT III ORDINARY DIFFERENTIAL EQUATIONS 12

Linear equations of second order and higher order with constant and variable coefficients – Homogeneous equation of Euler type – Legendre's equations – Methods of Variation parameter.

UNIT IV GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS 12

Curvature – Radius of Curvature for Cartesian and polar coordinates – Centre of Curvature Cartesian coordinates – Circle of curvature – Involutes and Evolutes.

UNIT V INTEGRAL CALCULUS 12

Methods of integration – Substitution rule – Integration by parts – bernoulli formula for integration – Definite integrals and its properties-Solving problems using Reduction formula.

TOTAL HOURS: 60

TEXT BOOK(S):

1. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.

REFERENCE BOOK(S):

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley & Sons. Singapore, 10th edition, 2012
2. K.Ganesan, Sundarammal Kesavan, K.S.Ganapathy Subramanian & V.Srinivasan, "Calculus and Solid Geometry", Revised Edition, 2013
3. Veerajan. T, Engineering Mathematics I, Tata McGraw Hill Publishing Co, New Delhi, 5th edition, 2006.
4. Kandasamy P etal. Engineering Mathematics, Vol.I (4th revised edition), S.Chand &Co., New Delhi, 2000.
5. Venkataraman M.K., Engineering Mathematics – First Year (2nd edition), National Publishing Co., Chennai, 2000.

COURSE OUTCOME(S):

CO102. 1 Make them to understand the fundamental knowledge of eigen values and eigen vectors.

CO102. 2 Make them to apply differentiation to solve maxima and minima problems.

CO102. 3 Make them to apply various techniques in solving differential equations.

CO102. 4 Make them to apply geometrical application in evolutes and involutes.

CO102. 5 Make them to evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	1		2						2			
CO202	2								2			3
CO203		2										
CO204	1		2						1			2
CO205		2	1									

1→Low 2→Medium 3→High

19GE1303 PHYSICS FOR ELECTRONICS ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To enhance the fundamental knowledge in Laser and Fiber Optics.
- Understand the electrical properties of conducting materials.
- Implement the essential principles of semiconducting materials.
- To impart knowledge on magnetic and dielectric materials.
- To enhance the fundamental knowledge in optical materials.

PRE-REQUISITE:

- Basic knowledge about laser, fibre optics and different kinds of materials.

UNIT I LASER AND FIBER OPTICS 9

Lasers: Principle of spontaneous emission and stimulated emission-population of energy levels-pumping-Einstein's A and B coefficients derivation – Semiconductor laser (Homojunction) - Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – fibre optic sensors: pressure and displacement.

UNIT II CONDUCTORS 9

Classical free electron theory – Expression for electrical conductivity – Thermal conductivity: expression – Wiedemann -Franz law –Merits and Demerits— Quantum theory- Fermi- Dirac statistics – Density of energy states – Carrier concentration, Fermi Energy in metals.

UNIT III SEMICONDUCTORS 9

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors – Carrier concentration in N-type& P-type semiconductors – Variation of carrier concentration with temperature – variation of Fermi level with temperature and impurity concentration — Hall effect and devices.

UNIT IV MAGNETIC AND DIELECTRIC MATERIALS 9

Magnetism in materials – magnetic field and induction – magnetization – magnetic permeability and susceptibility–types of magnetic materials –Domain Theory of Ferromagnetism- Dielectric materials: Polarization mechanism – dielectric loss –dielectric breakdown.

UNIT V OPTICAL MATERIALS 9

Classification of optical materials – carrier generation and recombination processes – Absorption, emission and scattering of light in metals, insulators and semiconductors– photo current in a P- N diode – solar cell –photo detectors – LED – Organic LED – Laser diodes.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Kasap, S.O. "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.
2. Umesh K Mishra & Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2008.
3. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
4. Pandey, B.K. & Chaturvedi, S. "Engineering Physics".Cengage Learning India 2012.

REFERENCE BOOK(S):

1. Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.
2. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
3. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
4. Mani.P, "Engineering Physics", Dhanam Publications, 16th edition, July 2017.
5. Srinivasan.P, "Physics for Electronics Engineering". Vishnu Prints Media, 1st edition Jan 2018

COURSE OUTCOME(S):

CO103. 1 Understand the concepts of Laser and applications in fibre optics.

CO103. 2 Apply the basic principles of classical and quantum electron theories.

CO103. 3 Understand the basics of semiconductor physics and its applications.

CO103. 4 Understand the concepts of magnetic and dielectric materials.

CO103. 5 Apply the functioning of optical materials for Optoelectronics.

WEB RESOURCES:

1. https://www.britannica.com/science/fibre optics (Unit I)
2. https://www.britannica.com/science/Fermi-Dirac-statistics (Unit II)
3. http://vlab.amrita.edu/?sub=1&brch=282&sim=879&cnt=1(Unit III)
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4934330/(Unit IV)
5. http://www.explainthatstuff.com/how-oleds-and-leps-work.html (Unit V)

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	3	1		2								2
CO302	3	3		2								2
CO303	3	3		2								2
CO304	3	3		2								2
CO305	3	3	2	2			1					2

1→Low 2→Medium 3→High

19GE1403 ENGINEERING CHEMISTRY L T P C
3 0 0 3

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To understand the characteristics and applications of catalysis.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To study the types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- To know the principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

PRE-REQUISITE:

- Basic theoretical concepts of Chemistry in higher secondary level.

UNIT I WATER AND ITS TREATMENT 9

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

UNIT II SURFACE CHEMISTRY AND CATALYSIS 9

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – applications of adsorption on

pollution abatement. Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – acid base catalysis – enzyme catalysis – catalytic poisoning and catalytic promoters – applications (catalytic convertor)

UNIT III ALLOYS AND PHASE RULE 9

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system – Pattinson's process.

UNIT IV FUELS AND COMBUSTION 9

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. 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).

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H_2-O_2 fuel cell.

TOTAL HOURS: 45

TEXT BOOK(S):

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

REFERENCE BOOK(S):

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

COURSE OUTCOME(S):

CO104. 1 The student will acquire knowledge on water treatment techniques that facilitate better understanding of engineering processes and applications for further learning.

CO104. 2 The student will attain greater knowledge about concepts such as heterogeneous catalysis, semiconductor device fabrication, fuel cells, self-assembled monolayers, and adhesives.

CO104. 3 The student can identify the different types of alloys that impart synergistic properties to the constituent metal elements such as corrosion resistance and mechanical strength.

CO104. 4 The student can analyse the economic and environmental case for transitioning to next generation or by profiling the advanced biofuel industry.

CO104. 5 The student will acquire greater knowledge on the concept and operation of available and relevant energy storage systems.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO401	2	2						1			2	2
CO402	2										1	1
CO403	2	2									1	1
CO404	2	2									1	2
CO405	2	2					1	2			2	1

1→Low 2→Medium 3→High

19CS1501 PYTHON PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python

PRE-REQUISITE:

- Basic Problem solving ideas, Analytical and Logical thinking

UNIT I ALGORITHMIC PROBLEM SOLVING 9

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

UNIT II DATA, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (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.

UNIT IV 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: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCE BOOK(S):

1. John V Guttag, ―Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,, 2015.
4. Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
5. Charles Dierbach, ―Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, ―Practical Programming: An Introduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

WEB RESOURCES:

1. https://www.python.org/about/gettingstarted/
2. https://www.tutorialspoint.com/python/python_functions.htm
3. https://nptel.ac.in/courses/106/106/106106182/

COURSE OUTCOME(S):

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

CO105. 1 Develop algorithmic solutions to simple computational problems
CO105. 2 Read, write, execute by hand simple Python programs.
CO105. 3 Structure simple Python programs for solving problems.
CO105. 4 Decompose a Python program into functions.
CO105. 5 Represent compound data using Python lists, tuples, dictionaries.
CO105. 6 Read and write data from/to files in Python Programs.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO501	3	3										1
CO502			3									
CO503			3									
CO504	3										1	
CO505	3		2									
CO506	3		2									

1→Low 2→Medium 3→High

19ME1502 ENGINEERING GRAPHICS L T P C
1 0 4 3

OBJECTIVES:

- To develop graphic skills in students.

PRE-REQUISITE:

- Basic knowledge on geometry and Conics.

UNIT I PLANE CURVES 9

Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – Construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT II PROJECTION OF POINTS AND LINES 9

Principles of projection, projection of points in four quadrants – Projection of straight lines located in the first quadrant – inclined to both planes – Determination of true lengths and true inclinations by rotating line method and traces.

UNIT III PROJECTION OF SOLIDS 9

Projection of simple solids like Prisms, Pyramids, Cylinder and Cone when the axis is inclined to one reference plane

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 9

Sectioning of above solids in simple vertical position by cutting planes inclined to HP and perpendicular to VP – Obtaining true shape of section Development of lateral surfaces of simple and sectioned solids – Prisms, Pyramids, Cylinder and Cone

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 9

Principles of isometric projection – isometric scale – isometric projections of truncated Prisms, Pyramids, Cylinder and Cone. Perspective projection of simple prism, pyramid and cylinder by Visual ray method.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited (2016)

2. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2015)

REFERENCE BOOK(S):

1. Kumar M.S., "Engineering Graphics", D.D. Publications, (2015)
2. Shah M.B. and Rana B.C., "Engineering Drawing", Pearson Education (2009)
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I & II combined), Subhas Stores, Bangalore, (2007)
4. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, (2008)
5. Parthasarathy N.S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, (2015)

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods

Special points applicable to end semester examination on Engineering Graphics:

1. There will be five questions in the end semester examination
2. All questions will carry equal marks of 20 each making a total of 100
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size

The end semester examination will be conducted in two sessions (FN and AN on the same day) for 50 percent of student (approx) at a time

COURSE OUTCOME(S):

CO106. 1 Construct plane curves

CO106. 2 Draw the projections of points and lines

CO106. 3 Draw the projections of simple solids

CO106. 4 Draw the sectional views of solids and the applications of development of surfaces

CO106. 5 Construct isometric and perspective projections

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO601	3								2			3
CO602	3								2			3
CO603	3								2			3
CO604	3								2			3
CO605	3								2			3

1→Low 2→Medium 3→High

19EC1311 PHYSICS AND CHEMISTRY LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To introduce the different experiments to test the basic understanding of physics concepts applied in optics, thermal physics and ultrasonics.
- To make the students to acquire practical skills in handling conducting, semiconducting and ferromagnetic materials.
- To acquire practical knowledge in properties of matter.
- To make the students to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis
- To develop and understanding of the range and uses of analytical methods in chemistry.

PRE-REQUISITE:

- Experiments in Physics and chemistry introduced at the higher secondary levels in schools.

Laboratory Experiments

PHYSICS LABORATORY (ANY FIVE EXPERIMENTS)

1. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.
2. Determination of band gap of a Semiconductor.
3. Determination of hysteresis losses in ferromagnetic material-B-H curve.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
6. Determination of Wavelength, and particle size using Laser
7. Determination of Numerical aperture and acceptance angle in an optical fiber.
8. Determination of Young's modulus of the material-Non Uniform bending method
9. Determination of wavelength of spectral lines using grating – Spectrometer.
10. Determination of rigidity modulus – Torsion pendulum.

CHEMISTRY LABORATORY (ANY FIVE EXPERIMENTS)

1. Estimation of Hcl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Estimation of copper content of the given solution by EDTA method.
4. Determination of strength of given hydrochloric acid using pH meter.
5. Estimation of iron content of the given solution using potentiometer.
6. Conductometric titration of strong acid vs. strong base.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Conductometric precipitation titration ($Bacl_2$ vs. Na_2SO_4).
9. Estimation of sodium and potassium present in water using flame photometer.
10. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.

TOTAL HOURS: 60

REFERENCE BOOK(S):

1. Physics Laboratory Manual, Department of Physics, Francis Xavier Engineering College, Tirunelveli.

2. Physics Laboratory Manual, Dr. G Senthilkumar VRB Publishers Pvt. Ltd.
3. Vogel's Textbook of Quantitative Chemical Analysis (8TH edition, 2014)

COURSE OUTCOME(S):

CO107. 1 The students will gain knowledge on the basics of optics, thermal physics and ultrasonics.

CO107. 2 The students will have adequate knowledge in handling conducting, semiconducting and ferromagnetic materials.

CO107. 3 The students will apply the principles of elasticity for Engineering applications.

CO107. 4 The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

CO107. 5 The students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO701	3	1							2		2	2
CO702	3	1							2		2	2
CO703	3	1							2		2	2
CO704	3	1							2		2	2
CO705	3	1							2		2	2

1→Low 2→Medium 3→High

19EC1511 PYTHON PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- Interpret the use of procedural statements like assignments, conditional statements, loops and function calls.
- To implement Python programs with conditionals and loops.
- Infer the supported data structures like lists, dictionaries and tuples in Python.
- Demonstrate proficiency in handling Strings
- Discover the use files and navigating the file systems in Python.

PRE-REQUISITE:

- HSC Computer Science.

Laboratory Experiments

1. a) Compute the GCD of two numbers.
   b) To calculate the average of numbers
   c) To read two numbers and print their quotient and remainder
   d) Exponentiation (power of a number)
2. Find the maximum of a list of numbers
3. Linear search and Binary search
4. Selection sort, Insertion sort
5. First n prime numbers

6. Multiply matrices
7. Programs using string methods
8. Program using packages.
9. Programs that take command line arguments (word count)
10. Find the most frequent words in a text read from a file
11. Simulate bouncing ball using Pygame

TOTAL HOURS: 60

REFERENCE BOOK(S):

1. Laboratory Manual, Department of ECE, FXEC.

COURSE OUTCOME(S):

CO108. 1 Examine Python syntax and semantics be fluent in the use of Python flow control and functions.

CO108. 2 Implement Python programs with conditionals, loops and strings.

CO108. 3 Develop Python programs step-wise by defining functions and calling them.

CO108. 4 Create, run and manipulate Python Programs using core data structures like Lists, Tuples and Dictionaries.

CO108. 5 Read and write data from/to files in Python.

PO vs CO MAPPING

CO No	**PO_a**	**PO_b**	**PO_c**	**PO_d**	**PO_e**	**PO_f**	**PO_g**	**PO_h**	**PO_i**	**PO_j**	**PO_k**	**PO_l**
CO801	3	3	2	3	3	1	1	1	3	1	3	2
CO802	3	3	2	3	3	1	1	1	3	1	3	2
CO803	3	3	2	3	3	2	1	1	3	1	3	2
CO804	3	3	2	3	3	1	1	1	3	1	3	2
CO805	3	3	2	3	3	1	1	1	3	1	3	2

1→Low 2→Medium 3→High

SECOND SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19GE2101	Technical Communication	HSS	2	0	0	2	2
19MA2201	Vector Calculus and Transforms	BS	3	1	0	4	4
19CS2503	C Programming	ES	3	0	0	3	3
19EC2502	Basic Electrical and Instrumentation Engineering	ES	3	1	0	4	4
19EC2511	Electrical and Electronics Practices Laboratory	ES	0	0	4	2	4
19EC2512	C Programming Laboratory	ES	0	0	4	2	4
19GE2M02	Fundamentals Of Computational Biology	BS	2	0	0	0	2
		TOTAL	**13**	**2**	**8**	**17**	**23**

19GE2101 TECHNICAL COMMUNICATION

L	**T**	**P**	**C**
2	**0**	**0**	**2**

OBJECTIVES:

- Widen strategies and skills to augment their ability to read and comprehend engineering and technology texts.
- Foster their capability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend technical lectures and talks in their areas of specialization.
- Cultivate writing skills both technical and general.

PRE-REQUISITE:

- The pre-requisite knowledge required by the Students to study this Course is basic knowledge in English Language.

UNIT I READING AND STUDY SKILLS 6

Listening - listening to longer technical talks ; Speaking – describing in detail the working process of any electronic/electrical machine ; Reading – reading longer technical texts and taking down notes – Note Making strategies ; Writing- interpreting charts, graphs; Vocabulary Development - Select Technical Vocabulary ; Language Development- Active Voice and Passive Voice.

UNIT II INTRODUCTION TO PROFESSIONAL WRITING 6

Listening- listening to talks mostly of a scientific/technical nature and completing information ; Speaking – Technical Presentations ; Reading –Technical related topics ; Writing- purpose statements – extended definitions - writing instructions – checklists - recommendations ; Vocabulary Development - select Technical Vocabulary ; Language Development – Subject Verb Agreement, Compound Words.

UNIT III INTERVIEW SKILLS 6

Listening- Listening to mock Interviews ; Speaking – answering Interview questions ; Reading – longer texts both general and technical, practice in speed reading ; Writing – Minutes of the Meeting – Writing opinion paragraph - Writing paragraphs with reasons ; Language Development - If – Conditionals

UNIT IV REPORT WRITING I 6

Listening- Listening to documentaries and making notes ; Speaking – making Technical Presentations ; Reading – reading for detailed comprehension ; Writing - Fire accident Report, Industrial Visit Report ; Vocabulary Development- finding suitable synonyms-paraphrasing ; Language Development - Clauses.

UNIT V REPORT WRITING II 6

Listening - listening to Reports ; Speaking – participating in a group discussion ; Reading – reading and understanding technical articles ; Writing – writing Feasibility Reports, Survey Reports ; Vocabulary Development - verbal analogies ; Language Development - advanced Use of Articles, Prepositional Phrases

TOTAL HOURS: 30

TEXT BOOK(S):

1. Butterfield, Jeff. Soft Skills for Every one. Cengage Learning: New Delhi, 2017.
2. Richards C. Jack and David Bohleke. Speak Now 4. Oxford Press 2014

REFERENCE BOOK(S):

1. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
2. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007
5. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice.Oxford University Press: New Delhi,2014

WEB RESOURCE(S):

1. Learn Engineering https://www.youtube.com/user/LearnEngineeringTeam/videos?view=0&sort=p&shelf_id=14
2. Engineering Dictionary https://www.engineering-dictionary.com/
3. Interpretation of Charts https://www.youtube.com/watch?v=cTWXaLX2L6Y
4. IELS Listening Practice https://play.google.com/store/apps/details?id=mimosa.english.ieltpractice.listening&hl=en_IN

COURSE OUTCOME(S):

CO201. 1 Read advanced technical texts and write area- specific texts effortlessly.

CO201. 2 Listen and comprehend extensive technical lectures and talks in their area of specialization successfully.

CO201. 3 Successfully answer questions during Interviews.

CO201. 4 Write good reports.

CO201. 5 Communicate effectively - adapting to purpose, structure, audience, and medium.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101				2			3		1	2	2	3
CO102				2			2		3	3	2	2
CO103				1			1		3	3	2	2

CO104				3			2		2	2	3	2
CO105				2			2		3	3	2	2

1→Low 2→Medium 3→High

19MA2201 VECTOR CALCULUS AND TRANSFORMS L T P C
3 1 0 4

OBJECTIVES:

- To have knowledge in multiple integrals.
- To improve their ability in Vector calculus.
- To improve the knowledge of Laplace transform.
- To expose to the concept of Analytical function.
- To familiarize with Complex integration.

PRE-REQUISITE:

- To study this course are basic knowledge about Vectors, continuous function and complex fields.

UNIT I MULTIPLE INTEGRALS 12

Double integration in Cartesian and polar coordinates– Area as a double integral in Cartesian and polar coordinates – Triple integration in Cartesian coordinates– Volume as a Triple Integral

UNIT II VECTOR CALCULUS 12

Gradient, divergence, Directional derivatives, curl –Angle between surfaces - Solenoidal and irrotational fields – Scalar potential – Vector identities (without proof)–Green's theorem – Gauss divergence theorem and Stoke's theorems (without proof).

UNIT III LAPLACE TRANSFORMS 12

Transforms of simple functions – Basic operational properties — Inverse transforms – Using Partial fraction – Convolution theorem – Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients only.

UNIT IV ANALYTIC FUNCTIONS 12

Definition of Analytic Function – Cauchy Riemann equations – Properties of analytic functions - Determination of harmonic conjugate and its properties – Milne-Thomson's method conformal mapping $w = c + z$, $w = 1 / z$ and bilinear transformation.

UNIT V COMPLEX INTEGRATION 12

Cauchy's integral theorem (without proof) – Cauchy's integral formulae and its applications – Cauchy's integral formulae for derivatives and its applications – Singularities – Poles and Residues – Cauchy's residue theorem.

TOTAL HOURS: 60

TEXT BOOK(S):

1. Grewal B.S, Higher Engg Maths, Khanna Publications, 42nd Edition, 2012.

REFERENCE BOOK(S):

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley & Sons. Singapore, 10th edition, 2012.
2. K.Ganesan, Sundarammal Kesavan, K.S.Ganapathy Subramanian & V.Srinivasan, "Advanced Calculus and Complex Analysis", Revised Edition, 2013.
3. Veerajan, T., Engineering Mathematics I, Tata McGraw Hill Publishing Co., New Delhi, 5th edition,.
4. Kandasamy P etal. Engineering Mathematics, Vol.I (4th revised edition), S.Chand & Co., New Delhi,2000
5. Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., Advanced Mathematics for Engineering students, Volume I (2nd edition), S.Viswanathan Printers and Publishers, 1992.

COURSE OUTCOME(S):

CO202. 1 Make them to apply integration to compute multiple integrals, area and volume.

CO202. 2 Make them to understand the basic concepts of gradient, divergences, curl of a vector point function.

CO202. 3 Make them to analyse laplace transforms and inverse laplace transforms of simple functions.

CO202. 4 Make them to understand and apply the concept of analytic functions, bilinear transformations.

CO202. 5 Make them to understand the concepts of cauchys theorem, cauchys integral formula.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	2								1			3
CO202	1	2										
CO203	2								2			
CO204		3							2			2
CO205	1	1										

1→Low 2→Medium 3→High

19CS2503 C PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To gain knowledge on the basic concepts of a computer system
- To get acquainted with the method of number system conversion
- To learn how to write modular and readable C program
- To learn to use pointers for storing data in the main memory efficiently
- To exploit the notion of derived data types

PRE-REQUISITE:

- Python Programming.

UNIT I COMPUTER FUNDAMENTALS 9

Generation and Classification of Computers - Basic Organization of a Computer - Hardware -

Classification of computer software – Number System: Binary, Decimal, Hexadecimal, Octal, and Conversion – Problem Solving Techniques: Introduction to Algorithm, Pseudo code, Flow Chart

UNIT II C – DATATYPES AND STATEMENTS 9

Structure of a 'C' program, compilation and linking processes - C Tokens: Constants, Variables – Data Types: Primitive Data Types, Type Definition, Enumeration, Qualifiers, Storage classes – Operators and Expressions - Managing Input and Output operations – Decision Making: Branching statements, Looping statements-Problem Solving with Basic statements

UNIT III ARRAYS AND STRINGS 9

Arrays: Declaration, Initialization, One dimensional, Two dimensional, and Multidimensional arrays - String: String operations – Manipulating String Arrays –Problem Solving with Arrays and Strings

UNIT IV FUNCTIONS AND POINTERS 9

Function : Declaration, Definition, Parameter passing methods, Recursion – Pointers: Declaration, Definition, Pointers and Functions, Pointer arithmetic, Pointer to an Array, Array of Pointers, Pointer to Pointer, Pointer to Void (generic pointer), Pointer to function - Dynamic Memory Allocation - Problem Solving with Functions and Pointers

UNIT V STRUCTURES, UNIONS AND FILE HANDLING 9

Structure: Need for Structure, Declaration, Definition, Structure within a Structure - Union - Files: File Management functions, Working with Text Files, and Binary Files -Pre-processor directives.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
2. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.
3. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006

REFERENCE BOOK(S):

1. Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. R.G. Dromey, "How to Solve it by Computer", Pearson Education,Fourth Reprint, 2007
3. Deitel.P.J and Deitel.H.M, "C How to Program", Fifth Edition, Prentice-Hall of India,2008
4. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

COURSE OUTCOME(S):

CO203. 1 Extrapolate the basics about computer.

CO203. 2 Develop C programs for a given problem.

CO203. 3 Explicitly manage memory using pointers.

CO203. 4 Store a large homogeneous data and record like data.

CO203. 5 Store the data for future use in structured and unstructured format.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	$PO1_k$	PO_l
CO301	3	1	1	2	1	1	1	1	3	1	1	2
CO302	3	2	1	2	1	1	1	1	3	1	1	2
CO303	3	2	1	2	1	1	1	1	3	1	1	2
CO304	3	2	1	2	1	1	1	1	3	1	1	2
CO305	3	2	1	2	1	1	1	1	3	1	1	2

1→Low 2→Medium 3→High

19EC2502 BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING L T P C
3 1 0 4

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.

PRE-REQUISITE:

- Physics for Electronics Engineers.

UNIT I AC CIRCUITS AND POWER SYSTEMS 12

Three phase power supply – Star connection – Delta connection – Balanced and Unbalanced Loads- Power equation – Star Delta Conversion – Three Phase Power Measurement - Transmission & Distribution of electrical energy – Over head Vs Underground system – Protection of power system – types of tariff – power factor improvement

UNIT II TRANSFORMERS 12

Introduction - Ideal Transformer – Accounting For Finite Permeability And Core Loss – Circuit Model Of Transformer – Per Unit System – Determination Of Parameters Of Circuit Model Of Transformer – Voltage Regulation – Name Plate Rating – Efficiency – Three Phase Transformers - Auto Transformers

UNIT III DC MACHINES 12

Introduction – Constructional Features– Motoring and generation principle - Emf And Torque equation – Circuit Model – Methods of Excitation and magnetisation characteristics – Starting and Speed Control – Universal Motor

UNIT IV AC MACHINES 12

Principle of operation of three-phase induction motors – Construction –Types – Equivalent circuit, Single phase Induction motors -Construction– Types–starting and speed control methods. Alternator- working principle–Equation of induced EMF – Voltage regulation, Synchronous motors working principle-starting methods – Torque equation – Stepper Motors – Brushless DC Motors

UNIT V MEASUREMENT AND INSTRUMENTATION 12

Type of Electrical and electronic instruments – Classification- Types of indicating Instruments – Principles of Electrical Instruments –Multimeters-Static and Dynamic Characteristics of Measurement – Errors in Measurement – Transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical

TOTAL HOURS: 60

TEXT BOOK(S):

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education(India) Private Limited, Third Reprint ,2016
2. Giorgio Rizzoni, "Principles and Applications of Electrical Engineering", McGraw Hill Education(India) Private Limited, 2010
3. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson India, 2011

REFERENCE BOOK(S):

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

COURSE OUTCOME(S):

CO204. 1 Understand the concept of three phase power circuits and measurement.

CO204. 2 Comprehend the concepts in transformers.

CO204. 3 Comprehend the concepts in DC Machines.

CO204. 4 Comprehend the concepts in AC Machines.

CO204. 5 Choose appropriate measuring instruments for desired application.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO401	3	3	3	3	1	1						3
CO402	3	3	3	3	2	1						3
CO403	3	3	3	3	2	2						3
CO404	3	3	3	3	2	1						3
CO405	3	3	3	2	2							3

1→Low 2→Medium 3→High

19EC2511 ELECTRICAL AND ELECTRONICS PRACTICES LABORATORY L T P C

0 0 4 2

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Electrical and Electronics Engineering.

PRE-REQUISITE:

- Physics for Electronics Engineer.

Laboratory Experiments

ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.

ELECTRONICS ENGINEERING PRACTCE

1. Study of Electronic components and equipments- Resistor Color Coding
2. Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO
3. Study of logic gates AND, OR, EX-OR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.

TOTAL HOURS: 60

REFERENCE BOOK(S):

1. Laboratory Manual, Department of ECE, FXEC

COURSE OUTCOME(S):

CO205. 1 Carry out basic home electrical works and appliances.

CO205. 2 Measure the electrical Parameters and quantities.

CO205. 3 Elaborate on the components, gates, soldering practices.

CO205. 4 Demonstrate the various electronic components and Resistor color coding.

CO205. 5 Apply various logic gates and able to solder various circuits using components.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO501	3	3	3	2		3	3		2			3
CO502	3	3	2	3		2			2			3
CO503	3	3	3	1	2				2			3
CO504	3	3	3	1	2				2			3
CO505	3	2	3	1					2			3

1→Low 2→Medium 3→High

19EC2512 C PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To develop C programs using conditional and looping statements
- To expertise in arrays and strings
- To build modular programs
- To explicitly manage memory using pointers
- To group different kinds of information related to a single entity
- To visualize and present data using office packages

PRE-REQUISITE:

- Python programming.

Laboratory Experiments

1. Programs using simple statements
2. Programs using decision making statements
3. Programs using looping statements
4. Programs using one dimensional and two dimensional arrays
5. Programs using user defined functions and recursive functions
6. Programs using functions and pointers
7. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
8. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
9. Check whether a given number is Armstrong number or not?
10. From a given paragraph perform the following using built-in functions:
    a. Find the total number of words.
    b. Capitalize the first word of each sentence.
    c. Replace a given word with another word.
11. Sort the list of numbers using pass by reference.
12. Generate salary slip of employees using structures and pointers.
13. Compute internal marks of students for five different subjects using structures and functions.

TOTAL HOURS: 60

REFERENCE BOOK(S):

1. Laboratory Manual, Department of ECE, FXEC.
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
3. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006
4. Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
5. Deitel.P.J and Deitel.H.M, "C How to Program", Fifth Edition, Prentice-Hall of India,2008
6. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

COURSE OUTCOME(S):

CO206. 1 Implement program using control statements.

CO206. 2 Handle arrays and strings.

CO206. 3 Develop reusable modules.

CO206. 4 Store data in main memory effectively using pointers.

CO206. 5 Form heterogeneous data using structures.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO601	3	2	1	2	1	1	1	1	3	1	1	2

CO602	3	2	1	2	1	1	1	1	3	1	1	2
CO603	3	2	1	2	1	1	1	1	3	1	1	2
CO604	3	2	1	2	1	1	1	1	3	1	1	2
CO605	3	2	1	2	1	1	1	1	3	1	1	2

1→Low 2→Medium 3→High

19GE2M02 FUNDAMENTALS OF COMPUTATIONAL BIOLOGY

L	T	P	C
2	0	0	0

OBJECTIVES:

- To introduce students to modern biology with an emphasis on evolution of biology as a multi-disciplinary field.
- To make them aware of application of engineering principles in biology, and engineering solutions inspired by biological examples.
- Know the principle of biosensor, classifications and the characteristics of different sensors and Study its biomedical applications.
- Understand the applications biology for computational applications in IT.

PRE-REQUISITE:

- HSC Biology.

UNIT I PHYSIOLOGY OF CELLS 6

Introduction to Biology – The Cell: Structure – Expression of genetic information – Cell Metabolism – Cellular differentiation – What is Computational Biology

UNIT II MOLECULAR BIOLOGY 6

Introduction to Molecules - chemical bonds – DNA – Structure – RNA – Protein Synthesis – Transcription – Translation – Stem cells – applications – DNA Computing.

UNIT III NERVOUS SYSTEM, IMMUNE SYSTEM & CELL SIGNALLING 8

Basics of nervous system and neural networks – cellular basis of immunity – functional properties of antibodies – T cell receptors – principles of cell signalling - Neuro morphic computing – Brain Computer Interface.

UNIT IV BIO SENSORS 5

Biosensors – Fundamentals – Components - Types – Designs – Applications.

UNIT V APPLICATIONS OF COMPUTATIONAL BIOLOGY 5

Bio Computers - Bio Informatics - Synthetic biology – Molecular programming – Tele Medicine– Computational biology towards Data Science.

TOTAL HOURS: 30

TEXT BOOK(S):

1. Thyaga Rajan.S., Selvamurugan. N., Rajesh.M.P., Nazeer.R.A., Richard W. Thilagaraj, Barathi.S., and Jaganthan.M.K., "Biology for Engineers", Tata McGraw-Hill, New Delhi, 2012.

REFERENCE BOOK(S):

1. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, "Biochemistry", W.H. Freeman and Co. Ltd., 6th Ed., 2006.
2. Robert Weaver, "Molecular Biology", MCGraw-Hill, 5th Edition, 2012. 4. Jon Cooper, "Biosensors A Practical Approach", Bellwether Books, 2004.
3. Martin Alexander, "Biodegradation and Bioremediation", Academic Press, 1994.
4. Kenneth Murphy, "Janeway's Immunobiology", Garland Science; 8th edition, 2011.
5. Eric R. Kandel, James H. Schwartz, Thomas M. Jessell, "Principles of Neural Science", McGraw-Hill, 5th Edition, 2012.

COURSE OUTCOME(S):

CO207. 1 Appreciate the structure and organization of basic unit of life- The cell.

CO207. 2 Understand the concept of DNA structure, RNA and Protein synthesis.

CO207. 3 Acquire knowledge about human central nervous system and immune system.

CO207. 4 Comprehended the different biosensors used to measure bio-potentials.

CO207. 5 Become aware of recent applications of computational biology.

PO vs CO MAPPING

CO No	**PO_a**	**PO_b**	**PO_c**	**PO_d**	**PO_e**	**PO_f**	**PO_g**	**PO_h**	**PO_i**	**PO_j**	**PO_k**	**PO_l**
CO701	3			2	1	2	3	1		1	1	3
CO702	3			2	1	2	3	1		1	1	3
CO703	3			2	1	2	3	1		1	1	3
CO704	3	2	3	2	3	2	3	1	2	2	1	3
CO705	3	2	3	2	3	2	3	1	3	2	2	3

1→Low 2→Medium 3→High

THIRD SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19MA3201	Transforms and Partial Differential Equations	BS	3	1	0	4	4
19EC3501	Fundamentals of Data Structure and OOPS	ES	3	0	0	3	3
19EC3601	Electronic Devices & Circuit Analysis	PC	3	0	0	3	3
19EC3602	Digital Electronics	PC	3	0	0	3	3
19EC3603	Signals and Systems	PC	3	0	0	3	3
19EC3511	Data Structure and OOPS Laboratory	ES	3	0	0	2	3
19EC3611	Electronic Devices and Circuit Laboratory	PC	0	0	4	2	4
19EC3612	Digital Electronics Laboratory	PC	0	0	4	2	4
19GE3M01	Communication And Soft Skills	EEC	0	0	2	0	2
		TOTAL	**18**	**1**	**10**	**22**	**29**

19MA3201 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

L	**T**	**P**	**C**
3	**1**	**0**	**4**

OBJECTIVES:

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used invarious situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

PRE-REQUISITE:

- Vector Calculus and Transforms.

UNIT I PARTIAL DIFFERENTIAL EQUATION 12

Formation of PDE-Solutions of standard types –lagrange's linear equations- –Linear partial differential equations of Homogenous type.

UNIT II FOURIER SERIES 12

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

UNIT III APPLICATIONS OF FOURIER SERIES 12

Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS 12

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL HOURS: 60

TEXT BOOK(S):

1. Grewal B.S, Higher Engg Maths, Khanna Publications, 42nd Edition, 2014.

REFERENCE BOOK(S):

1. Kreyszig.E, “Advanced Engineering Mathematics”, John Wiley & Sons. Singapore, 10th edition, 2012.
2. Narayanan S., ManicavachagomPillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
3. Veerajan, T., Engineering Mathematics I, Tata McGraw Hill Publishing Co., New Delhi, 5th edition,.
4. Kandasamy P etal. Engineering Mathematics, Vol.I (4th revised edition), S.Chand &Co., New Delhi,2000
5. G. James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.

COURSE OUTCOME(S):

CO301. 1 Understand how to solve the given standard partial differential equations.

CO301. 2 Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.

CO301. 3 The physical Appreciate significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations

CO301. 4 Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

CO301. 5 Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	1	2							2			
CO102	1	2	1									3
CO103		3	2									
CO104	2		2						2			2
CO105	1								3			

1→Low 2→Medium 3→High

19EC3501 FUNDAMENTALS OF DATA STRUCTURE AND OOPS L T P C

3 0 0 3

OBJECTIVES:

- To learn how to develop code using oops
- To learn how to inherit the programs and how to hide a data.

- To explore the applications of linear data structures.
- To explore the applications of non linear data structures.
- To learn the basic sorting and searching algorithms.

PRE-REQUISITE:

- C Programming.

UNIT I DATA ABSTRACTION & OVERLOADING 9

Overview of C++ – Structures – Class Scope and Accessing Class Members – Reference Variables – Initialization – Constructors – Destructors – Member Functions and Classes – Friend Function – Dynamic Memory Allocation – Static Class Members –Overloading: Function overloading and Operator Overloading.

UNIT II INHERITANCE & POLYMORPHISM 9

Base Classes and Derived Classes – Protected Members – Casting Class pointers and Member Functions – Overriding – Public, Protected and Private Inheritance – Constructors and Destructors in derived Classes – Implicit Derived – Class Object To Base – Class Object Conversion — Virtual functions – This Pointer – Abstract Base Classes and Concrete Classes – Virtual Destructors – Dynamic Binding.

UNIT III LINEAR DATA STRUCTURES 9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists –Polynomial Manipulation - Stack ADT – Queue ADT - Evaluating arithmetic expressions.

UNIT IV NON-LINEAR DATA STRUCTURES 9

Trees – Binary Trees – Binary tree representation and traversals – Application of trees: Set representation and Union-Find operations – Graph and its representations – Graph Traversals – Representation of Graphs – Breadth-first search – Depth-first search - Connected components.

UNIT V SEARCHING AND SORTING ALGORITHMS 9

Sorting algorithms: Insertion sort - Quick sort - Merge sort - Searching: Linear search –Binary Search.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Deitel and Deitel, "C++, How to Program", Tenth Edition, Pearson Education, 2017.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", fourth Edition, Addison-Wesley, 2014.

REFERENCE BOOK(S):

1. Adam Drozdek,"Data Structures and Algorithms in C++", fourth Edition Cengage Learning, 2012.

COURSE OUTCOME(S):

CO302. 1 Develop and implement code using oops.

CO302. 2 Create programs that inherit and hide the data.

CO302. 3 Create applications in C++ using linear data structures.

CO302. 4 Create applications in C++ using non linear data structures.

CO302. 5 Develop programs using sorting and searching algorithms.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	3	1	2	1	1	1	1	3	1	1	2
CO202	3	3	1	2	1	1	1	1	3	1	1	2
CO203	3	3	1	2	1	1	1	1	3	1	1	2
CO204	3	3	1	2	1	1	1	1	3	1	1	2
CO205	3	3	1	2	1	1	1	1	3	1	1	2

1→Low 2→Medium 3→High

19EC3601 ELECTRONIC DEVICES & CIRCUIT ANALYSIS L T P C
3 0 0 3

OBJECTIVES:

- To introduce electric circuits and its analysis.
- To impart knowledge on solving circuits using network theorems.
- Be exposed to basic electronic devices.
- Be familiar with the theory, construction, and operation of FET, MOSFET.
- To introduce the basic concepts of special semiconductor devices.

PRE-REQUISITE:

- Basic Electrical and Instrumentation Engineering

UNIT I CIRCUIT ANALYSIS TECHNIQUES 9

Kirchoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

UNIT II TRANSIENT RESONANCE IN RLC CIRCUITS 9

Basic RL, RC and RLC circuits and their responses to pulse and sinusoidal inputs – frequency response – Parallel and series resonances – Q factor – single tuned and double tuned circuits.

UNIT III SEMICONDUCTOR DIODES & BJT 9

Theory of PN junction diode – current equation – space charge and diffusion capacitances – effect of temperature and breakdown mechanism – Zener diode and its characteristics Tunnel diodes – PIN diode, varactor diode- Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations – Breakdown in transistors.

UNIT IV FET 9

Principle of operation and comparison of N-Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET – thermal effect on MOSFET.

UNIT V SPECIAL SEMICONDUCTOR DEVICES 9

SCR characteristics and two transistor equivalent model – UJT – Diac and Triac – CCD, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells – LCD.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Shaum series,Tata McGraw Hill, (2017)
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits",Tata McGraw Hill, 2nd Edition, (2011).
3. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, (2008).

REFERENCE BOOK(S):

1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, 7th Education, (2006).
2. William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering Circuit Analysis",Tata McGraw Hill, 6th Edition, 2002.
3. J. Millman & Halkins, Satyebranta Jit, "Electronic Devices & Circuits",Tata McGraw Hill, 2nd Edition, 2008.

COURSE OUTCOME(S):

CO303. 1 Ability analyse electrical circuits.

CO303. 2 Ability to apply circuit theorems.

CO303. 3 Ability to analyse AC and DC Circuits.

CO303. 4 Explain the theory, construction, and operation of basic electronic devices.

CO303. 5 Use the basic electronic devices.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	3	3		2	3	3					3	3
CO302	3	3	2	2		3	1				3	3
CO303	3	3									3	3
CO304	3	3	2	2		3	1				3	3
CO305	3	3									3	3

1→Low 2→Medium 3→High

19EC3602 DIGITAL ELECTRONICS L T P C

3 0 0 3

OBJECTIVES:

- To familiarize with the design of various combinational digital circuits using logic gates.
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits.
- To explain the various semiconductor memories and related technology.
- To introduce the electronic circuits involved in the making of logic gates.

PRE-REQUISITE:

- Physics For Electronics Engineering

UNIT I DIGITAL FUNDAMENTALS 9

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1_s and 2_s complements, Codes – Binary, BCD, Excess 3, Gray, , Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization.

UNIT II COMBINATIONAL CIRCUIT DESIGN 9

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder,

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment, circuit implementation – Design of Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 9 Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits.

UNIT V MEMORY DEVICES AND DIGITAL INTEGRATED CIRCUITS 9

Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL.

TOTAL HOURS: 45

TEXT BOOK(S):

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 6th Edition, Pearson, 2018.

REFERENCE BOOK(S):

1. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
2. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011
3. S.Salivahanan and S.Arivazhagan "Digital Electronics", Ist Edition, Vikas Publishing House pvt Ltd, 2012.
4. Anil K.Maini "Digital Electronics", Wiley, 2014.
5. A.Anand Kumar "Fundamentals of Digital Circuits", 4th Edition, PHI Learning Private Limited, 2016.
6. Soumitra Kumar Mandal "Digital Electronics", McGraw Hill Education Private Limited, 2016.

COURSE OUTCOME(S):

CO304. 1 Use digital electronics in the present contemporary world.

CO304. 2 Design various combinational digital circuits using logic gates.

CO304. 3 Do the analysis and design procedures for synchronous and asynchronous sequential circuits.

CO304. 4 Use electronic circuits involved in the design of logic gates.

CO304. 5 Use the semiconductor memories and related technology.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO401	3	3	2									2
CO402	3	2	2									2
CO403	3	3	3	2								2
CO404	3	3	3	2								2
CO405	3	3	3		3							2

1→Low 2→Medium 3→High

19EC3603 SIGNALS AND SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To study the types and properties of various signals and systems
- To learn Laplace Transform &Fourier transform and their properties
- To know Z transform & DTFT and their properties
- To characterize LTI systems in the Time domain and various Transform domains

PRE-REQUISITE:

- Vector Calculus and Transforms

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Continuous and discrete time signals-Standard Signals: Unit impulse, unit step, unit ramp, exponential, and sinusoidal signals - Basic Operations on Signals- Classification of signals: Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals- Basic properties of systems: Linearity, Causality, time invariance, stability and Dynamic Properties

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Fourier series representation of continuous time periodic signals- properties of continuous time Fourier series- Fourier transform of continuous time aperiodic signals and periodic signals-properties of continuous time Fourier transform-Laplace Transforms and properties

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 9

LTI CT System: Convolution integral - Differential Equation-Block diagram representation-Analysis of CT systems: Fourier and Laplace transforms- ROC and its properties-Stability and Causality.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Sampling: Representation of continuous time signals by its sample - Sampling theorem – Reconstruction of a Signal from its samples, aliasing - Fourier series representation of discrete time sig nals- Properties

- Discrete Time Fourier Transform (DTFT)-Properties - Inverse DTFT- Z Transform – Properties of Z Transform

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 9

LTI DT System: Linear and Circular Convolutions- Sectioned Convolution- Difference Equations-Block diagram representation -Analysis of DT Systems: Fourier and Z Transform - ROC and its properties - Stability and Causality

TOTAL HOURS: 45

TEXT BOOK(S):

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson, 2015.

REFERENCE BOOK(S):

1. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, "Signals & Systems - Continuous and Discrete", Pearson, 2007.
3. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.

COURSE OUTCOME(S):

CO305. 1 To be able to determine if a given system is linear/causal/stable.

CO305. 2 Capable of determining the frequency components present in a deterministic signal.

CO305. 3 Capable of characterizing LTI systems in the time domain and frequency domain.

CO305. 4 Convert a continuous time signal into discrete time signal and reconstruct the continuous time signal.

CO305. 5 To be able to compute the output of an LTI system in the time and frequency domains.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO501	3	3	3	2	2							2
CO502	3	3	3	2	2							2
CO503	3	3	3	2	2							2
CO504	3	3	3	2	2							2
CO505	3	3	3	2	2							2

1→Low 2→Medium 3→High

19EC3511 DATA STRUCTURE AND OOPS LABORATORY L T P C

0 0 4 2

OBJECTIVES:

- Learn C++ programming language.
- Be exposed to the different data structures.
- Be familiar with applications using different data structures.

PRE-REQUISITE:

- C Programming

LIST OF EXPERIMENTS:

1. Basic Programs for C++ Concepts
2. Array implementation of List Abstract Data Type (ADT)
3. Linked list implementation of List ADT
4. Cursor implementation of List ADT
5. Stack ADT - Array and linked list implementations
6. The next two exercises are to be done by implementing the following source files
   i. Program source files for Stack Application 1
   ii. Array implementation of Stack ADT
   iii. Linked list implementation of Stack ADT
   iv. Program source files for Stack Application 2
   v. An appropriate header file for the Stack ADT should be included in (i) and (iv)
7. Implement any Stack Application using array implementation of Stack ADT (by implementing files (i) and (ii) given above) and then using linked list
8. Implementation of Stack ADT (by using files (i) and implementing file (iii))
9. Implement another Stack Application using array and linked list implementations of Stack ADT (by implementing files (iv) and using file (ii), and then by using files (iv) and (iii))
10. Queue ADT – Array and linked list implementations
11. Search Tree ADT - Binary Search Tree
12. Implement an interesting application as separate source files and using any of the searchable ADT files developed earlier. Replace the ADT file alone with other appropriate ADT files. Compare the performance.
13. Quick Sort

TOTAL HOURS: 60

WEB RESOURCE(S):

1. www.spoken-tutorial.org

COURSE OUTCOME(S):

CO306. 1 Design and implement C++ programs for manipulating stacks, queues, linked lists, trees, and graphs.

CO306. 2 Develop Code using OOPS concept.

CO306. 3 Design programs to inherit and hide the data.

CO306. 4 Apply good programming design methods for program development.

CO306. 5 Apply the different data structures for implementing solutions to practical problems.

PO vs CO MAPPING

CO	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO601	3	3	3	3	1	1	1	1	3	1	1	2
CO602	3	3	3	3	1	1		1	3		1	2
CO603	3	3	3	3		1	1	1	3			2
CO604	3	3	3	3	1	1	1	1	3	1	1	2
CO605	3	3	3	3			1	1	3	1	1	2

1→Low 2→Medium 3→High

19EC3611 ELECTRONIC DEVICES AND CIRCUIT LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- Be exposed to RL and RC circuits.
- Be familiar with Thevinin & Norton theorem KVL & KCL, and Super Position Theorems.
- Be exposed to the characteristics of basic electronic devices.

PRE-REQUISITE:

- Electronic Devices & Circuit Analysis

LIST OF EXPERIMENTS:

1. Verifications Of Thevinin & Norton theorem
2. Verifications Of KVL & KCL
3. Verifications Of Super Position Theorem
4. verifications of maximum power transfer & reciprocity theorem
5. Determination Of Resonance Frequency of Series & Parallel RLC Circuits
6. Characteristics of PN Junction Diode and Zener diode
7. Common Emitter input-output Characteristics
8. FET Characteristics
9. Simulation of CB configuration using PSPICE
10. Simulation of CC configuration using PSPICE

TOTAL HOURS: 60

COURSE OUTCOME(S):

CO307. 1 Design RL and RC circuits

CO307. 2 Verify Thevinin & Norton theorem KVL & KCL, and Super Position Theorems Design graph algorithms to compute the shortest path of the given graph and to identify the minimum spanning tree.

CO307. 3 Learn the characteristics of basic electronic devices

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO701	3		2	3					3	2	3	3
CO702	3		2			3			3		3	3
CO703	3		2	2					3	2	3	3

1→Low 2→Medium 3→High

19EC3612 DIGITAL ELECTRONICS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- Design and implement of logic circuits using basic gates.
- Design and implement the Combinational and sequential logic circuits.
- Design of implement Asynchronous and Synchronous circuits.

PRE-REQUISITE:

- Digital Electronics

LIST OF DIGITAL EXPERIMENTS

1. Design and implementation of code converters using logic gates
    a. BCD to excess-3 code and vice versa
    b. Binary to gray and vice-versa
2. Design and implementation of 4 bit binary Adder and BCD adder using IC 7483
3. Design and implementation of 4 bit binary Subtractor and BCD adder using IC 7483
4. Design and implementation of De-multiplexer using logic gates
5. Design and implementation of Half Adder and Half Subtractor using logic gates
6. Design and implementation of Full Adder and Full Subtractor using logic gates
7. Design and implementation of Multiplexer using logic gates
8. Design and implementation of encoder using logic gates
9. Design and implementation of decoder using logic gates
10. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters
11. Design and implementation of 3-bit synchronous up/down counter

TOTAL HOURS: 60

COURSE OUTCOME(S):

CO308. 1 Design and Test the digital logic circuits.
CO308. 2 Measure the functions of logic circuits.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO801	3	3		2					3	1	3	3
CO802	3	3	2	2					3	1	3	3

1→Low 2→Medium 3→High

19GE3M01 COMMUNICATION AND SOFT SKILLS

L	T	P	C
0	0	2	0

OBJECTIVES:

- Provide Guidance and Practice to communicate in English.
- Provide support to read from different genres.
- Practice to write technical articles.
- Understand the Importance of Soft skills
- Improve Personality Traits

PRE-REQUISITE:

- The pre-requisite knowledge required by the Students to study this Course is the fundamental knowledge in English Language.

UNIT I LISTENING SKILLS 6

Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries - listening to lectures, discussions from TV/ Radio/ Podcast - Video tutorials.

UNIT II READING AND WRITING SKILLS 6

Reading different genres of tests ranging from newspapers to creative writing; Writing abstracts – summaries - interpreting visuals - Attributes to technical Writing - Assembly Guidelines – White paper writing - Informal Usability Report – Release/launch notes.

UNIT III WRITING STRATEGIES 6

Introduction to Writing Strategies – different genres of writing – including instruction manuals, proposals, reports, posters and visual communication, technical descriptions, product recalls - Executive Summaries - Repair manuals - organizing ideas from Journal writings – Note-Making

UNIT IV PERSONALITY TRAITS – AN OVERVIEW 6

Definition – Types – Openness to experience – Conscientiousness – extraversion – Agreeableness – Neuroticism – Problem solving skills – examine ideas and develop theories and explanations

UNIT V SOFT SKILLS 6

Motivation – self image – goal setting – managing changes – time management – stress management – leadership traits – team work – career and life planning.

TOTAL HOURS: 30

TEXT BOOK(S):

1. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press: Oxford, 2011.
2. Mitra, K. Barun. Personality Development and Soft Skills. Oxford University Press: Oxford, 2016.

REFERENCE BOOK(S):

1. Personality Development (CD-ROM), Times Multimedia, Mumbai.
2. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
3. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.

WEB RESOURCE(S):

1. Learn Engineering https://www.youtube.com/user/LearnEngineeringTeam/videos?view=0&sort=p&shelf_id=14
2. Group Discussion https://www.youtube.com/watch?v=hhjvTUv9L0g
3. Presentation Skills https://www.youtube.com/watch?v=wp4ho9raVjA&t=74s
4. IELS Listening Practice https://play.google.com/store/apps/details?id=mimosa.english.ieltpractice.listening&hl=en_IN

COURSE OUTCOME(S):

CO309. 1 Talk in English in real life situations.

CO309. 2 Make effective presentations.

CO309. 3 Participate in GD and contribute ideas with ease.

CO309. 4 Master soft skills required for the work place.

CO309. 5 Write letters and technical writing.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO901				1			1		3	3	1	2
CO902				1			1		3	3	1	2
CO903				1			1		3	3	1	2
CO904				1			1		3	3	1	2
CO905				1			1		3	3	1	2

1→Low 2→Medium 3→High

FOURTH SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19EC4201	Probability and Random Process	BS	3	1	0	4	4
19EC4601	Analog and Digital Communication	PC	3	0	0	3	3
19EC4602	Analog Electronics	PC	3	0	0	3	3
19EC4603	Electromagnetic fields	PC	3	0	0	3	3
19EC4604	Discrete Time Signal Processing	PC	3	0	0	3	3
19GE4M01	Environmental Science and Engineering	BS	2	0	0	0	2
19EC4611	Analog and Digital Communication Laboratory	PC	0	0	4	2	4
19EC4612	Analog Electronics Laboratory	PC	0	0	4	2	4
		TOTAL	**17**	**1**	**8**	**20**	**26**

19EC4201 PROBABILITY AND RANDOM PROCESS

L	**T**	**P**	**C**
3	**1**	**0**	**4**

OBJECTIVES:

- To provide necessary basic concepts in probability and random processes for applications
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields
- To understand the concept of correlation and spectral densities
- To understand the significance of linear systems with random inputs.

PRE-REQUISITE:

- Transforms and Partial Differential Equations

UNIT I RANDOM VARIABLES 12

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables.

UNIT III RANDOM PROCESSES 12

Classification – Stationary process-Strict sense stationary-Wide sense stationary-Involutionary – Poisson process – Random telegraph process.

UNIT IV CORRELATION AND SPECTRAL DENSITIES 12

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties

UNIT V LINEAR SYSTEM WITH RANDOM INPUT 12

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and Cross correlation functions of input and output

TOTAL HOURS: 60

TEXT BOOK(S):

1. Ibe, O.C. "Fundamentals of Applied Probability and Random Processes", Elsevier, U.P., 1st Indian Reprint, 2007
2. Peebles. P.Z., "Probability, Random Variables and Random Signal Principles", Tata McGraw Hill, 4th Edition, New Delhi, 2002.

REFERENCE BOOK(S):

1. Yates. R.D. and Goodman. D.J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012
2. Stark. H., and Woods. J.W., "Probability and Random Processes with Applications to Signal Processing", 3rd Edition, Pearson Education, Asia, 2002
3. Miller. S.L. and Childers. D.G., "Probability and Random Processes with Applications to Signal Processing and Communications", Academic Press, 2004.

COURSE OUTCOME(S):

CO401. 1 Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.

CO401. 2 Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.

CO401. 3 Apply the concept random processes in engineering disciplines.

CO401. 4 Understand and apply the concept of correlation and spectral densities.

CO401. 5 The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable. Able to analyze the response of random inputs to linear time invariant systems.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	1		2						2			
CO102		2	2						3			
CO103	2								2			2
CO104	1		1									
CO105		2										3

1→Low 2→Medium 3→High

19EC4601 ANALOG AND DIGITAL COMMUNICATION

L	T	P	C
3	1	0	4

OBJECTIVES:

- To study the various analog modulation techniques
- To study the various digital modulation techniques
- To study the principles behind information theory and coding
- To study the various digital communication techniques
- Gain knowledge on multi-user radio communication.

PRE-REQUISITE:

- Transforms and Partial Differential Equations

UNIT I ANALOG COMMUNICATION 9

Introduction to Communication Systems - Modulation – Types - Need for Modulation. Theory of Amplitude Modulation - Evolution and Description of DSBSC, SSBSC and VSB- Theory of Frequency and Phase Modulation - Superheterodyne receivers – Comparison of Analog Communication Systems (AM – FM – PM).

UNIT II DIGITAL MODULATION AND TRANSMISSION 9

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency–ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers.

UNIT III PULSE MODULATION 9

Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM), DM - ADM, Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing.

UNIT IV INFORMATION THEORY AND CODING 9

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, Error Control Coding, linear block codes, Syndrome calculation, cyclic codes, Convolution Coding, Viterbi decoding.

UNIT V SPREAD SPECTRUM AND MULTIPLE ACCESS 9

PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS – Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA.

TOTAL HOURS: 45

TEXT BOOK(S):

1. H Taub, D L Schilling, G Saha, “Principles of Communication Systems” 4/e, TMH 2017.
2. S. Haykin “Digital Communications” John Wiley 2006.

REFERENCE BOOK(S):

1. B.P.Lathi, “Modern Digital and Analog Communication Systems”, 3rd edition, Oxford University Press, 2007
2. H P Hsu, Schaum Outline Series “Analog and Digital Communications” TMH 2006
3. B.Sklar, “Digital Communications Fundamentals and Applications” 2/e Pearson Education 2007

COURSE OUTCOME(S):

CO402. 1 Students can able to apply analog communication techniques.

CO402. 2 Students can able to apply digital communication techniques.

CO402. 3 Students will be able to develop system for correcting transmission errors.

CO402. 4 Students will use data and pulse communication techniques.

CO402. 5 Utilize multi-user radio communication.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	3	3	3	3	3					3	3
CO202	3	3	3	3	3	3					3	3
CO203	2	3	3	3	3	2					2	3
CO204	3	3	3	3	3	3					3	3
CO205	2	3	3	3	3	3					3	3

1→Low 2→Medium 3→High

19EC4602 ANALOG ELECTRONICS L T P C

3 0 0 3

OBJECTIVES:

- Learn about biasing of BJTs and MOSFETs
- Study high frequency response of all amplifiers
- To understand the advantages and method of analysis of feedback amplifiers.
- To understand the analysis and design of LC and RC oscillators, amplifiers, multivibrators, and time base generators.

PRE-REQUISITE:

- Electronic Devices & Circuit Analysis

UNIT I BIASING OF DISCRETE BJT AND MOSFET 9

Introduction -DC Load line, operating point, various biasing methods for BJT-Design Stability-Bias compensation, Thermal stability, Design of biasing for JFET, Design of biasing for MOSFET

UNIT II SMALL SIGNAL AMPLIFIERS 9

Small signal Analysis of Common Emitter-AC Load line, Voltage swing limitations, Common collector and common base amplifiers – Differential amplifiers- CMRR- Darlington Amplifier- Bootstrap technique - Cascaded stages - Cascode Amplifier -Small signal Analysis of MOSFET and JFET - BiMOS Cascode amplifier.

UNIT III FREQUENCY ANALYSIS OF BJT AND MOSFET AMPLIFIERS 9

Low frequency and Miller effect, High frequency analysis of CE and MOSFET CS amplifier, Short circuit current gain, cut off frequency – fα and fβ unity gain and Determination of bandwidth of single stage and multistage amplifiers.

UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Basic principles and types of feedback - Gain of an amplifier employing feedback - Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier. Use of positive feedback - Barkhausen criterion for oscillations - Different oscillator circuits - tuned collector, Hartley Colpitts, phase shift, Wien's bridge, and crystal oscillator.

UNIT V LARGE SIGNAL AND TUNED AMPLIFIERS 9

Large Signal Amplifiers - Class A, Class B, Class AB, and Class C amplifiers, Series and parallel resonant circuits and bandwidth of resonant circuits, Tuned Amplifiers - Single and double tuned amplifiers - Stagger tuned amplifiers –Stability of tuned amplifiers

TOTAL HOURS: 45

TEXT BOOK(S):

1. Donald .A. Neamen, Electronic Circuit Analysis and Design –2nd Edition,Tata Mc Graw Hill, 2009.
2. Adel S. Sedra and Kenneth C.Smith, "Microelectronic Circuits", Oxford University Press, 7th Edition, 2017.

REFERENCE BOOK(S):

1. Behzad Razavi, "Fundamentals of Microelectronics", 1st edition, Wiley publication, 2008.
2. Millman & Halkias, "Integrated Electronics", 48th reprint, Tata McGraw Hill, 2008.
3. David A., "Bell Electronic Devices and Circuits", Oxford Higher Education Press, 5th Edition, 2010.

COURSE OUTCOME(S):

CO403. 1 Design circuits with transistor biasing.

CO403. 2 Design simple amplifier circuits and analyze the small signal equivalent circuits of transistors.

CO403. 3 Derive the expression for Q point, CMRR of differential amplifier.

CO403. 4 Derive the frequency of oscillation and condition of Oscillation of RC and LC Oscillators.

CO403. 5 Derive the equation for power output and conversion efficiency of Class A, Class B and Class C of large signal amplifiers.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	3	3	3	2		1			2			3
CO302	3	3	3	2		3			2			3
CO303	3	3	3	2					2			3
CO304	3	3	2	2		1			2			3
CO305	3	3	2	2					2			3

1→Low 2→Medium 3→High

19EC4603 ELECTROMAGNETIC FIELDS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To gain knowledge on vector calculus.
- To acquire knowledge of various static electric and magnetic fields.
- To understand the combination between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations.

PRE-REQUISITE:

- Basic Electrical and Instrumentation Engineering

UNIT I INTRODUCTION 9

Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical 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

UNIT II ELECTROSTATIC FIELDS 9

Introduction- Electric Field-Electric Field Intensity -Electric Field due to discrete charges - Electric field due to continuous charge distribution Electric Field due to charges distributed uniformly on a finite line - Electric Field on the axis of a uniformly charged circular disc and uniformly charged sheet. Electric Scalar Potential – Relationship between potential and electric field - Potential due to electrical dipole - Electric Flux Density Electrostatic energy and energy density-Gauss Law and Applications

UNIT III STATIC MAGNETIC FIELD 9

The Biot-Savart Law in vector form - Magnetic Field intensity due to a finite and infinite wire carrying a current I - Magnetic field intensity on the axis of a circular loop carrying a current I - Ampere's circuital law and simple applications. Magnetic flux density - The Lorentz force equation for a moving charge and applications - Force on a wire carrying a current I placed in a magnetic field -Magnetic Vector Potential.

UNIT IV ELECTRIC AND MAGNETIC FIELDS IN MATERIALS AND DIELECTRICS 9

Properties of materials- convection and conduction current-conductors- polarization in dielectrics- types of dielectrics- continuity equation and relaxation time- Boundary conditions for electric fields – Definition of Capacitance - Capacitance of various geometries using Laplace's equation-Classification of magnetic materials - magnetic boundary conditions- inductors-inductances – magnetic energy.

UNIT V PLANE ELECTROMAGNETIC WAVES 9

Introduction of Maxwell-s equations from Faraday's Ampere's law and Gauss's law for time varying fields. Wave equations and solutions Waves between parallel planes of perfect conductors, Electromagnetic power flow and Poynting Theorem.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Mathew N O Sadiku, Electromagnetic Fields, Oxford University Press, 6th edition, 2014.

2. William H Hayt, John A Buck, Engineering Electromagnetics, McGraw-Hill Higher Education,8th edition, 2011

REFERENCE BOOK(S):

1. Bhag Guru and Huseyin Hiziroglu, Electromagnetic Field Theory Fundamentals, Cambridge University Press, 2nd edition, 2004
2. D.J. Griffiths, Introduction to electrodynamics, 4th ed., Pearson (India), 2013
3. B.M. Notaros, Electromagnetics, Pearson: New Jersey, 2011

COURSE OUTCOME(S):

CO404. 1 To gain conceptual and basic mathematical understanding of electric and magnetic fields infree space and in materials.

CO404. 2 Analyze the behaviour of static Electric fields in free space.

CO404. 3 Analyze the behaviour of static magnetic fields in free space.

CO404. 4 Apply the concepts of static electric and magnetic fields in materials.

CO404. 5 Interpret guided waves in both electric and magnetic modes.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO401	3	2				1	2	2		2		3
CO402	2	3				1	2	2		3		2
CO403	3	2				2	1	2		1		3
CO404	3	2				2	1	2		1		2
CO405	3	2				2	1	2		1		3

1→Low 2→Medium 3→High

19EC4604 DISCRETE TIME SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To learn discrete Fourier transform, properties of DFT and its application to linear filtering.
- To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands.
- To understand the effects of finite precision representation on digital filters.
- To understand the fundamental concepts of multi rate signal processing and its applications.
- To introduce the concepts of adaptive filters and its application to communication engineering.

PRE-REQUISITE:

- Signals and Systems

UNIT I DISCRETE FOURIER TRANSFORM 9

Concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, 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.

UNIT II INFINITE IMPULSE RESPONSE FILTERS 9

Characteristics of practical frequency selective filters, Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (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.

UNIT III FINITE IMPULSE RESPONSE FILTERS 9

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

UNIT IV FINITE WORD LENGTH EFFECTS 9

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

UNIT V DSP APPLICATIONS 9

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

TOTAL HOURS: 45

TEXT BOOK(S):

1. John G. Proakis & Dimitris G.Manolakis, “Digital Signal Processing – Principles, Algorithms & Applications”, Fourth Edition, Pearson Education / Prentice Hall, 2007

REFERENCE BOOK(S):

1. Emmanuel C..Ifeachor, & Barrie.W.Jervis, “Digital Signal Processing”, Second Edition, Pearson Education / Prentice Hall, 2002.
2. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”, Tata Mc Graw Hill, 2007.
3. A.V.Oppenheim, R.W. Schafer and J.R. Buck, “Discrete-Time Signal Processing”, 3rd Indian Reprint, Pearson, 2014.
4. Andreas Antoniou, “Digital Signal Processing”, Tata Mc Graw Hill, 2006.

COURSE OUTCOME(S):

CO405. 1 Apply DFT for the analysis of digital signals and systems.

CO405. 2 Design IIR Filters.

CO405. 3 Design IIR Filters.

CO405. 4 Characterize the effects of finite precision representation on digital filters.

CO405. 5 Design multirate filters &Apply adaptive filters appropriately in communication systems.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO501	2	3	3	3	2	2				2	1	2
CO502	3	2	3	2	1	1				2		3
CO503	2	2	2	2	2	2				2	2	2
CO504	2	2	2	2	1	1				2		3
CO505	2	2	2	2	1	1				2		3

1→Low 2→Medium 3→High

19GE4M01 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
2 0 0 0

OBJECTIVES:

- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth‟s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

PRE-REQUISITE:

- Basic theoretical concepts of biological science in higher secondary level.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 7

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – ecological succession– Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) pond ecosystem (d) ocean ecosystem – Introduction to biodiversity definition: genetic, species and ecosystem diversity – value of biodiversity–India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India –In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 6

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution– solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 6

Forest resources: Use and over-exploitation, deforestation - timber extraction– Water resources: Use and over- utilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Role of an individual in conservation of natural resources.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 6

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – consumerism and waste products – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 5

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL HOURS: 30

TEXT BOOK(S):

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCE BOOK(S):

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) Pvt, Ltd, Hydrabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

COURSE OUTCOME(S):

CO406. 1 The student will acquire knowledge about the different biodiversity species and their importance.

CO406. 2 The student can classify problems related to the environmental degradation.

CO406. 3 The Students will attain greater knowledge of how natural resources relate to the economy and environment at present and in the future.

CO406. 4 The student can identify a societal problem and to develop a plan of action to address the issues.

CO406. 5 The student can analyse the changes due to population explosion.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO601							2	2				
CO602						3	3	1				
CO603								3				
CO604						3	3					
CO605						2		1				

1→Low 2→Medium 3→High

19EC4611 ANALOG AND DIGITAL COMMUNICATION LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To Implement AM & FM modulation and demodulation.
- To implement PCM & DM.
- To simulate Digital Modulation schemes.

PRE-REQUISITE:

- Analog and Digital Communication

Laboratory Experiments

1. Signal Sampling and reconstruction.
2. AM Modulator and Demodulator
3. FM Modulator and Demodulator
4. Pulse Code Modulation and Demodulation
5. Delta Modulation and Demodulation
6. Line coding schemes
7. Simulation of ASK, FSK, and BPSK generation schemes
8. Simulation of DPSK, QPSK and QAM generation schemes
9. Simulation of signal constellations of BPSK, QPSK and QAM
10. Simulation of ASK, FSK and BPSK detection schemes
11. Simulation of Linear Block and Cyclic error control coding schemes
12. Simulation of Convolutional coding scheme
13. Communication link simulation

TOTAL HOURS: 60

COURSE OUTCOME(S):

CO407. 1 Students will be able to sample and reconstruct the signal.

CO407. 2 Students will be able to modulate and demodulate a signal.

CO407. 3 Students will understand the various line coding schemes.

CO407. 4 Students will be able to simulate any digital modulation techniques.

CO407. 5 Students can correct the transmission errors.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO701	3	3	3	3	3	3				3	3	3
CO702	3	2	3	3	3	3					3	3
CO703	3	2	3	3	3	3					3	3
CO704	3	3	2	3	3	3					3	3
CO705	3	3	3	3	3	3					2	3

1→Low 2→Medium 3→High

19EC4612 ANALOG ELECTRONICS LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To gain hands on experience in designing electronic circuits.
- To differentiate the operation of various multivibrators.
- Perform SPICE simulation of Electronic Circuits.

PRE-REQUISITE:

- Analog Electronics

Laboratory Experiments

1. Frequency Response of CE amplifier
2. Darlington Amplifier
3. Differential Amplifiers- Transfer characteristic, CMRR Measurement
4. RC Phase shift oscillator and Wien Bridge Oscillator
5. Hartley Oscillator and Colpitts Oscillator
6. Single Tuned Amplifier
7. Series and Shunt feedback amplifiers-Frequency response, Input and output impedance.
8. Analysis of Cascode and Cascade amplifiers using PSpice.
9. Analysis of Frequency Response of BJT and FET using PSpice.
10. Double and Stagger tuned Amplifiers using PSpice
11. Class A and Class B Power Amplifiers using PSpice

TOTAL HOURS: 60

REFERENCE BOOK(S):

1. Laboratory Manual, Department of ECE, FXEC.
2. David A Bell, “Laboratory Manual for Electronic Devices and Circuits”, 4th edition, D.A. Bell, 2001.
3. L. K. Maheshwari, M. M. S. Anand, “Laboratory Experiments and PSPICE Simulations in Analog Electronics”, PHI, 2006

COURSE OUTCOME(S):

CO408. 1 Analyze the bandwidth of single stage and multi stage amplifier.

CO408. 2 Measure CMRR in differential amplifier.

CO408. 3 Analyze various types of feedback amplifiers.

CO408. 4 Design oscillator and tuned amplifiers.

CO408. 5 Simulate and analyze amplifier circuits using PSpice.

PO vs CO MAPPING

CO No	**PO_a**	**PO_b**	**PO_c**	**PO_d**	**PO_e**	**PO_f**	**PO_g**	**PO_h**	**PO_i**	**PO_j**	**PO_k**	**PO_l**
CO801	3	3							3	1	3	3
CO802	3	2	3	3					3	1	3	3
CO803	3	3	3			1			3		3	3
CO804	3	3		2					3	2	3	3
CO805	3	3		2					3		3	3

1→Low 2→Medium 3→High

FIFTH SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19EC5601	Control Systems	PC	3	0	0	3	3
19EC5602	Linear Integrated Circuits	PC	3	0	0	3	3
19EC5603	Microprocessor and Microcontroller Programming and Interfacing	PC	3	0	0	3	3
	Professional Elective – I	PE	3	0	0	3	3
	Professional Elective – II	PE	3	0	0	3	3
	Open Elective I	OE	3	0	0	3	3
19EC5611	Linear Integrated Circuits Laboratory	PC	0	0	4	2	4
19EC5612	Microprocessor and Microcontroller Laboratory	PC	0	0	4	2	4
19GE5M01	Interpersonal Skills Essentials	EEC	0	0	2	0	2
19GE5M02	Professional Ethics in Engineering	HSS	2	0	0	0	2
		TOTAL	**20**	**0**	**10**	**22**	**30**

EC195601 CONTROL SYSTEMS

L	**T**	**P**	**C**
3	**0**	**0**	**3**

OBJECTIVES:

- To introduce mathematical modelling of different components and different types of control systems.
- To learn various methods to analyse response of control systems in time domain and frequency domain.
- To learn various methods to analyze the stability of control systems.
- To study the control system in state variable representation.

PRE-REQUISITE:

- Transforms and Partial Differential Equations

UNIT I SYSTEM COMPONENTS AND THEIR REPRESENTATION 9

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Systems-Transfer Function Models-Electrical Analogy-Block diagram Models-Signal flow graphs models.

UNIT II TIME RESPONSE ANALYSIS 9

Standard test signals – Time response specifications-Time response of First and Second order system for step input and ramp input - poles & zeros-effect of additional pole & additional zero-Steady state error constants, generalized error series -Basics of P,PI,PD,PID Controller.

UNIT III FREQUENCY RESPONSE ANALYSIS & DESIGN 9

Frequency domain specifications- Frequency response of standard second order system- Bode Plot - Polar

Plot- Design Procedure of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation.

UNIT IV STABILITY ANALYSIS 9

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

UNIT V STATE VARIABLE REPRESENTATION 9

Introduction to state space analysis- State models of linear systems - 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- State transition matrix, State space representation of discrete time system

TOTAL HOURS: 45

TEXT BOOK(S):

1. M.Gopal, "Control System – Principles and Design" , Tata McGraw Hill, 4th Edition, 2012.

REFERENCE BOOK(S):

1. J.Nagrath and M.Gopal, ―Control System Engineering, New Age International Publishers, 5th Edition, 2007.
2. K. Ogata, Modern Control Engineering, 5th edition, PHI, 2012.
3. S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
4. Benjamin.C.Kuo, ―Automatic control systems, Prentice Hall of India, 7th Edition, 1995.
5. A.Nagoor Kani, Control System Engineering, RBA Publication, 1st Edition.

COURSE OUTCOME(S):

CO501. 1 Ability for mathematical representation of mechanical & translational systems in transfer function model, electrical analogy, block diagram reduction model & signal flow graph model.

CO501. 2 Ability to analyze control systems in time domain.

CO501. 3 Ability to analyze control systems in frequency domain.

CO501. 4 Ability to analyze the stability of control systems.

CO501. 5 Ability to analyze different models of control systems in state variable representation.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	3	3	2	3	2	1					1	3
CO102	3	3	3	3	2	1					1	3
CO103	3	3	3	3	2	1					1	3
CO104	3	3	3	3	2	1					1	3
CO105	3	3	2	3	2	1					1	3

1→Low 2→Medium 3→High

19EC5602 LINEAR INTEGRATED CIRCUITS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basic building blocks of linear integrated circuits.
- To learn the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To learn the theory of ADC and DAC.
- To introduce the concepts of waveform generation and introduce some special function ICs.

PRE-REQUISITE:

- Analog Electronics

UNIT I BASICS OF OPERATIONAL AMPLIFIERS 9

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

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS 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, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

UNIT III ANALOG MULTIPLIER AND PLL 9

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

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS 9

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode *R - 2R* Ladder types - switches for D/A converters, 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

UNIT V WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS 9

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, Function generator IC, Timer IC 555 -IC 723 general purpose regulator -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.

TOTAL HOURS: 45

TEXT BOOK(S):

1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. ltd., 2018, Fifth Edition.
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, Tata Mc Graw-Hill, 2016.

REFERENCE BOOK(S):

1. Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2015
2. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2001.
3. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, 5th Edition, 2009
4. William D.Stanley, "Operational Amplifiers with Linear Integrated Circuits", Pearson Education, 4th Edition, 2001
5. S.Salivahanan & V.S. Kanchana Bhaskaran, "Linear Integrated Circuits", TMH, 2nd Edition 4th Reprint, 2016.

COURSE OUTCOME(S):

CO502. 1 Design linear and non linear applications of OP – AMPS.

CO502. 2 Design applications using analog multiplier and PLL.

CO502. 3 Design ADC and DAC using OP – AMPS.

CO502. 4 Generate waveforms using OP – AMP Circuits.

CO502. 5 Analyze special function ICs

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	3	3	3	1	1				2	3	3
CO202	3	3	3	3	1	1				2	3	3
CO203	3	3	3	3	1	1				2	3	3
CO204	3	3	2	2	1	1				2	3	3
CO205	3	3	2	2	1	1				2	3	3

1→Low 2→Medium 3→High

19EC5603 MICROPROCESSOR AND MICROCONTROLLER PROGRAMMING AND INTERFACING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Study the Architecture of 8086 microprocessor.
- Learn the design aspects of I/O and Memory Interfacing circuits.
- Study about communication and bus interfacing.
- Study and learn the design aspects of Architecture of 8051 microcontroller.

PRE-REQUISITE:

- Analog and Digital Communication

UNIT I THE 8086 MICROPROCESSOR 9

Introduction to 8086 – Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming – Modular Programming – Linking and Relocation – Stacks – Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT II 8086 SYSTEM BUS STRUCTURE 9

8086 signals – Basic configurations – System bus timing –System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

UNIT III I/O INTERFACING 9

Memory Interfacing and I/O interfacing – Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

UNIT IV MICROCONTROLLER 9

Architecture of 8051 – Special Function Registers (SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming- PIC16F877-features-advantages- home automation system using pic

UNIT V INTERFACING MICROCONTROLLER 9

Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing – External Memory Interface- Stepper Motor and Waveform generation.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011

COURSE OUTCOME(S):

CO503. 1 Understand and execute programs based on 8086 microprocessor.

CO503. 2 Design Memory Interfacing circuits.

CO503. 3 Design and interface I/O circuits.

CO503. 4 Understand and execute programs based on 8051 microprocessor.

CO503. 5 Understand about the high performance CISC architecture.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	3											
CO302	3	2			3					3		2
CO303	3											
CO304	3	2		3						3		3
CO305	3	2	3	3	3	2				3	3	3

1→Low 2→Medium 3→High

19EC5611 LINEAR INTEGRATED CIRCUITS LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To understand the basics of linear integrated circuits and available ICs.
- To understand the characteristics of the operational amplifier.
- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function IC.
- To use SPICE software for circuit design.

PRE-REQUISITE:

- Linear Integrated Circuits

DESIGN AND TESTING OF THE FOLLOWING CIRCUITS

1. Inverting, Non inverting amplifiers
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Active low-pass, High-pass filters
5. Astable & Monostable multivibrators using Op-amp
6. Schmitt Trigger using op-amp
7. Astable and Monostable multivibrators using NE555 Timer
8. PLL characteristics and its use as Frequency Multiplier, Clock synchronization
9. R-2R Ladder Type D- A Converter using Op-amp

SIMULATION USING SPICE:

1. Astable and Monostable multivibrators using NE555 Timer
2. Active low-pass, High-pass and band-pass filters using Op-amp
3. A/ D converter
4. Analog multiplier

TOTAL HOURS: 60

COURSE OUTCOME(S):

CO507. 1 Design amplifiers, oscillators, D-A converters using operational amplifiers.

CO507. 2 Design filters using op-amp and performs an experiment on frequency response.

CO507. 3 Analyze the working of PLL and describe its application as a frequency multiplier.

CO507. 4 Design DC power supply using ICs.

CO507. 5 Analyze the performance of filters, multivibrators, A/D converter and analog multiplier using SPICE.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO701	3	3	3	3	1	1				2	3	3
CO702	3	3	3	3	1	1				2	3	3
CO703	3	3	3	2	1	1				2	3	3
CO704	3	3	3	3	1	1				2	3	3
CO705	3	3	3	2	3	1				2	3	3

1→Low 2→Medium 3→High

19EC5612 MICROPROCESSOR AND MICROCONTROLLER LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- Write ALP for arithmetic and logical operations in 8086 and 8051.
- Differentiate Serial and Parallel Interface.
- Interface different I/Os with Microprocessors.
- Be familiar with MASM.

PRE-REQUISITE:

Microprocessor and Microcontroller Programming and Interfacing

LIST OF EXPERIMENTS:

8086 Programs using kits and MASM

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching
5. Counters and Time Delay

Peripherals and Interfacing Experiments

6. Traffic light controller
7. Stepper motor control
8. Key board and Display
9. Serial interface and Parallel interface
10. A/D and D/A interface and Waveform Generation

8051 Experiments using kits and MASM

11. Basic arithmetic and Logical operations
12. Find 2‘s complement of a number

TOTAL HOURS: 60

TEXT BOOK(S):

1. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011.

2. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware",TMH,2012

COURSE OUTCOME(S):

CO508. 1 Write ALP Programmes for fixed and Floating Point and Arithmetic operations.

CO508. 2 Interface different I/Os with processor.

CO508. 3 Generate waveforms using Microprocessors.

CO508. 4 Execute Programs in 8051.

CO508. 5 Explain the difference between simulator and Emulator.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO801	3	3		2	3			2		2		2
CO802	3	3		2	3			2		2		2
CO803	3	3		2	3			2		2		
CO804	3	3		2	3			2		2		2
CO805	3	3		2	3			2				2

1→Low 2→Medium 3→High

19GE5M01 INTERPERSONAL SKILLS ESSENTIALS L T P C
0 0 2 0

OBJECTIVES:

- Recognize the characteristics of competent communication in dyadic interactions.
- Demonstrate the ability to assess the appropriateness and effectiveness of interpersonal strategies used in various interpersonal situations.
- Demonstrate skill in selecting and using a variety of communication strategies and responses based on situational contexts, goals, and human needs.
- Recognize the ethical dimensions of interpersonal skills.

PRE-REQUISITE:

- The pre-requisite knowledge required by the Students to study this Course is the fundamental knowledge in English Language.

UNIT I VERBAL COMMUNICATION 6

Introducing Interpersonal Communication - Considering Self - Perceiving Others - Determine project topic and questions for Improving - Interpersonal Communication – Oral Presenting of innovative ideas – Assignment analysis.

UNIT II DECISION-MAKING 6

Introduction - Objectives and Expectations - Classifying Decisions - valuating Alternatives: Plus-Minus-Implication – Project Direction – Writing down decision statements - Understanding Culture - Evaluating Alternatives: Paired Comparison - Supportive Listening Skills Demonstration - Team Decision Making - Communicating Verbally - Conflict Analysis - Visual idea Presentation.

UNIT III PROBLEM-SOLVING 6

Identifying problems – Writing problem statement, Analyzing the situation -Gathering information related to the problem stated - Identifying solution criteria - Choosing the best solution - Implementing a solution – writing solution content - Measuring solution success – Report preparation.

UNIT IV CRITICAL THINKING AND INFORMATION ANALYSIS 6

Critical thinking Introduction - Developing reasoning and logical skills - Discussing forecasting techniques – Writing Quantitative analysis - Discussing mind mapping.

UNIT V NEGOTIATION SKILLS 6

Understanding the hidden complexities and dynamics of negotiation - Internalising the roles played by relationships, trust and rapport - Strategically preparing for any negotiation scenario – writing implementation and compliance statements.

TOTAL HOURS: 30

TEXT BOOK(S):

1. Pease, Allan and Barbara Pease. The Definitive Book of Body Language. New Delhi: Manjul Publishing House, 2005.
2. Robbins P.Stephen, Hunsaker Philip.Training in Interpersonal Skill. 6th Edition. New Delhi: Pearson, 2015.

WEB RESOURCE(S):

1. Interpersonal Communication https://www.youtube.com/watch?v=L8NhxVXopaU
2. Decision Making https://www.youtube.com/watch?v=pPIhAm_WGbQ
3. Problem Solving https://www.youtube.com/watch?v=DCjC_cG4vF4
4. Critical Thinking https://www.youtube.com/watch?v=J0yEAE5owWw
5. Negotiation Skills https://www.youtube.com/watch?v=DZntD2KEJs0

COURSE OUTCOME(S):

CO509. 1 **Civic and Cultural Awareness:** Analyzing and critiquing competing perspectives in a democratic society; comparing, contrasting, and interpreting differences and commonalities among peoples, ideas, aesthetic traditions, and cultural practices.

CO509. 2 **Critical Thinking:** Gathering, analyzing, synthesizing, evaluating and applying information.

CO509. 3 **Personal Responsibility:** Identifying and applying ethical principles and practices; demonstrating effective learning, creative thinking, and personal responsibility.

CO509. 4 **Interpersonal Skills:** Interacting collaboratively to achieve common goals.

CO509. 5 **Written, Oral, and Visual Communication:** Communicating effectively, adapting to purpose, structure, audience, and medium.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO901		1	2	2		3	3	2	2	2	2	2
CO902		1	3	2							3	
CO903		1	2			3			2	2		

CO904		1	2						3	3	1	1
CO905		1	2							3	2	

1→Low 2→Medium 3→High

19GE5M02 PROFESSIONAL ETHICS IN ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

PRE-REQUISITE:

- Technical Communication

UNIT I HUMAN VALUES 6

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality.

UNIT II ENGINEERING ETHICS 6

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg‘s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 6

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 6

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights.

UNIT V GLOBAL ISSUES 6

Multinational Corporations – Computer Ethics –Engineers as Managers – Consulting Engineers – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

TOTAL: 30 PERIODS

TEXT BOOK(S):

1. Mike W. Martin and Roland Schinzinger, ―Ethics in Engineering‖, Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, ―Engineering Ethics‖, Prentice Hall of India, New Delhi, 2004.

REFERENCE BOOK(S):

1. Charles B. Fleddermann, ―Engineering Ethics‖, Pearson Prentice Hall, New Jersey, 2004.

2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, ―Engineering Ethics – Concepts and Cases‖, Cengage Learning, 2009.
3. John R Boatright, ―Ethics and the Conduct of Business‖, Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, ―Fundamentals of Ethics for Scientists and Engineers‖, Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, ―Business Ethics: Decision Making for Personal Integrity and Social Responsibility‖ Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, _ Value Education', Vethathiri publications, Erode, 2011.

WEB RESOURCE(S):

- www.onlineethics.org
- www.nspe.org
- www.globalethics.org
- www.ethics.org

COURSE OUTCOME(S):

CO705-6. 1 The student should be able to apply ethics in human values.

CO705-6. 2 The student should be able to apply ethics in engineering.

CO705-6. 3 The student should be able to discuss the ethical issues related to engineering

CO705-6. 4 The student should be able to realize the responsibilities and rights in the society.

CO705-6. 5 The student should be able to apply ethics in global issues.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO601						3		3	2	3	3	3
CO602						3		3	2	3	3	3
CO603						3		3	2	3	3	3
CO604						3		3	2	3	3	3
CO605						3		3	2	3	3	3

1→Low 2→Medium 3→High

SIXTH SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19EC6601	Transmission Lines and Antennas	PC	3	0	0	3	3
19EC6602	VLSI System Design	PC	3	0	0	3	3
	Professional Elective – III	PE	3	0	0	3	3
	Professional Elective – IV	PE	3	0	0	3	3
	Professional Elective – V	PE	3	0	0	3	3
	Open Elective II	OE	3	0	0	3	3
19EC6911	Internship and Mini Project	EEC	0	0	4	2	4
19EC6912	Interpersonal Skills –Listening and Learning	EEC	0	0	4	2	4
19EC6613	VLSI System Design Laboratory	PC	0	0	4	2	4
19GE6M01	Life Skills Aptitude	EEC	2	0	0	0	2
19GE6M02	Intellectual Property Rights	HSS	2	0	0	0	2
		TOTAL	**22**	**0**	**12**	**24**	**34**

19EC6601 TRANSMISSION LINES AND ANTENNAS

L	**T**	**P**	**C**
3	**0**	**0**	**3**

OBJECTIVES:

- To introduce the various types of transmission lines and to discuss the losses associated.
- To give thorough understanding about impedance transformation and matching.
- To use the Smith chart in problem solving.
- To give insight of the radiation phenomena.
- To create awareness about the different types of propagation of radio waves at different frequencies.

PRE-REQUISITE:

- Electromagnetic fields

UNIT I TRANSMISSION LINE THEORY 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 Z0 - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

UNIT II HIGH FREQUENCY TRANSMISSION LINES 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.

UNIT III IMPEDANCEMATCHING IN HIGH FREQUENCY LINES 9

Impedance matching: Quarter wave transformer - Impedance matching by stubs - Single stub and double stub matching - Smith chart - Solutions of problems using Smith chart - Single and double stub matching using Smith chart.

UNIT IV FUNDAMENTALS OF RADIATION 9

Definition of antenna parameters – Gain, Directivity, Effective aperture, Radiation Resistance, Band width, Beam width, Input Impedance. Matching – Baluns, Polarization mismatch, Antenna noise temperature, Radiation from oscillating dipole, Half wave dipole. Folded dipole, Yagi array.

UNIT V ARRAYS AND SPECIAL ANTENNAS 9

N element linear array, Pattern multiplication, Broadside and End fire array - Principle of frequency independent antennas – Helical antenna, Log periodic. Modern antennas- Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications, Antenna Measurements-Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR.

TOTAL HOURS: 45

TEXT BOOK(S):

1. John D Ryder, “Networks, lines and fields”, 2nd Edition, Prentice Hall India, 2015
2. John D Kraus,” Antennas for all Applications”, 3rd Edition, Mc Graw Hill, 2008
3. Edward C.Jordan and Keith G.Balmain” Electromagnetic Waves and Radiating Systems” Prentice Hall of India, 2006
4. S. Drabowitch, “Modern Antennas” Second Edition, Springer Publications, 2007

COURSE OUTCOME(S):

CO601. 1 Discuss the propagation of signals through transmission lines.

CO601. 2 Analyze signal propagation at Radio frequencies.

CO601. 3 Problem solving by smith chart.

CO601. 4 Explain the various types of antennas and wave propagation.

CO601. 5 Analyze the antenna arrays, aperture antennas and special antennas such as frequency independent and broad band.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	3	2	2									1
CO102		2	2		3							1
CO103		1	2		2							
CO104				1	3	1				2		
CO105	1	1		1	3	1			3			1

1→Low 2→Medium 3→High

19EC6602	**VLSI DESIGN**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To learn the fundamentals of VLSI design
- To understand the IC Manufacturing Process
- To familiarize with VLSI combinational logic circuits design
- To familiarize with VLSI sequential logic circuits design
- To learn the various arithmetic circuits and testing methodologies
- To familiarize with the different FPGA architectures

PRE-REQUISITE:

- Digital Electronics

UNIT I MOS TRANSISTOR PRINCIPLES 9

MOS Technology and VLSI, Pass transistors, NMOS, CMOS Fabrication process and Electrical properties of CMOS circuits and Device modelling. Characteristics of CMOS inverter, Scaling principles and fundamental limits. Propagation Delays, CMOS inverter scaling, Stick diagram, Layout diagrams, Elmore‘s constant, Logical Effort. Case study: Study of technology development in MOS.

UNIT II COMBINATIONAL LOGIC CIRCUITS 9

Static CMOS logic Design, Design techniques to improve the speed, power dissipation of CMOS logic, low power circuit techniques, Ratioed logic .Pass transistor Logic, Transmission CPL, DCVSL, Dynamic CMOS logic, Domino logic, Dual Rail logic, NP CMOS logic and NORA logic

UNIT III SEQUENTIAL LOGIC CIRCUITS 9

Static and Dynamic Latches and Registers, Timing Issues, Pipelines, Clocking strategies, Memory Architectures, and Memory control circuits.

UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS & TESTING 9

Data path circuits, Architectures for Adders, Accumulators, Multipliers, Barrel Shifters, Need for testing- Manufacturing test principles- Design for testability. Case study: Analysis of area, power and delay for 16 bit adder and 8 bit multilpier.

UNIT V IMPLEMENTATION STRATEGIES 9

Full Custom and Semicustom Design, Standard Cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures. Demo: Complete ASIC flow using Backend tool and fabrication flow Overall case study: Development of IC in commercial aspects (design, testing and fab cost)

TOTAL HOURS: 45

TEXT BOOK(S):

1. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, “Digital Integrated circuits: A Design Perspective”, Prentice Hall of India, 2nd Edition, 2003.
2. Uyemura, John P, ”Introduction to VLSI Circuits and Systems”. Wiley & Sons, 8th Reprint 2009.

REFERENCE BOOK(S):

1. N.Weste, K.Eshraghian, "Principles of CMOS VLSI DESIGN", A system Perspective, 2nd Edition, Addision Wesley, 2004.
2. A.Pucknell, Kamran Eshraghian, "BASIC VLSI DESIGN", Prentice Hall of India, 3rd Edition, 2007.
3. Michael John Sebastian Smith, " Applications Specific Integrated Circuits", Pearson Education, Ninth Indian reprint,13th edition,2004.
4. R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India, 2005.

WEB RESOURCE(S):

- MIT Open courseware: http://ocw.mit.edu/courses/electrical-engineering-andcomputer-science/6-374-analysis-and-design-of-digital-integrated-circuits/.
- https://nptel.ac.in/courses/108/107/108107129/
- https://nptel.ac.in/courses/106/105/106105161/

COURSE OUTCOME(S):

CO602. 1 Ability to analyze inverter characteristics and realize modeling of MOS transistors.

CO602. 2 Ability to design combinational logic using various logic styles, satisfying static and dynamic requirements.

CO602. 3 Ability to analyze timing issues of sequential logic and design memories.

CO602. 4 Ability to design data path elements.

CO602. 5 Ability to compare and analyze FPGA architecture and interconnect methodology.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	1	1										
CO202	3	2	3	2								1
CO203	2	3	2	3	1	1						2
CO204			1	1								3
CO205						2					1	

1→Low 2→Medium 3→High

19EC6912 INTERPERSONAL SKILLS- LISTENING AND SPEAKING

L	T	P	C
0	0	4	2

OBJECTIVES:

- Master themselves with English Language Skills required for undertaking academic listening and speaking skills.
- Support them to practice formal and informal speaking activities.
- Improve their listening skills to understand native speakers.
- Make technical Presentation.
- Listen to on-line sources.

PRE-REQUISITE:

- The pre-requisite knowledge required by the Students to study this Course is the fundamental knowledge in English Language.

UNIT I LISTENING AS A KEY SKILL 6

Importance of Listening – preparing to listen to a lecture – basics of Note Taking - listening to personal information – listening to technical topics – listening to process information.

UNIT II LISTENING STRATEGY 6

Appreciative listening - listening to Non-Technical Video Lecture by Native Speakers – focus on sounds and words ; Critical Listening – Listening to Technical Video Lecture by Native speakers – identifying the key points ; Relationship Listening – Listening to Conversations by native speakers.

UNIT III INTERMEDIATE SPEAKING 6

Self Introduction – Sharing of Ideas – Briefing Academic topics – one to one conversation about a product – explaining a product/gadget – answering questions – stressing syllables –intonation patterns – compare and contrast information – Pronunciation.

UNIT IV ADVANCED SPEAKING 6

Making Technical Presentation – Strategies - Extempore – Speaking about the Strengths & Weaknesses – Responding appropriately to Interview Questions – Group discussion.

UNIT V ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS 6

International English Language Testing System (IELTS) – Test of English as a Foreign Language (TOEFL) – Civil Service (Language related)- Verbal Ability.

TOTAL HOURS: 30

TEXT BOOK(S):

1. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards, C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010.

REFERENCE BOOK(S):

1. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014.

WEB RESOURCE(S):

1. Learn Engineering
   https://www.youtube.com/user/LearnEngineeringTeam/videos?view=0&sort=p&shelf_id=14

2. Group Discussion https://www.youtube.com/watch?v=hhjvTUv9L0g
3. Interview Skills https://www.youtube.com/watch?v=QgjkjsqAzvo
4. TED Talk https://www.youtube.com/user/TEDtalksDirector
5. IELS Listening Practic**e**
   https://play.google.com/store/apps/details?id=mimosa.english.ieltpractice.listening&hl=en_IN

COURSE OUTCOME(S):

CO607. 1 Listen and respond appropriately.

CO607. 2 Present TED Talks.

CO607. 3 Make Effective Technical Presentations.

CO607. 4 Take up National and International Examination with ease.

CO607. 5 Answer questions during interview process with a professional touch.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO701				1			1		3	3	1	2
CO702				1			1		3	3	1	2
CO703				1			1		3	3	1	2
CO704				1			1		3	3	1	2
CO705				1			1		3	3	1	2

1→Low 2→Medium 3→High

19EC6613 VLSI SYSTEM DESIGN LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To learn the Hardware Description Language (Verilog/VHDL)
- To learn the fundamental principles of VLSI circuit design in digital and analog domain.
- To simulate and verify the synthesis report for digital circuits.
- To familiarize fusing of logical modules on FPGAs.
- To provide hands on design experience with professional design (EDA)

PRE-REQUISITE:

- Digital Electronics Laboratory

Digital and Analog Experiments

Part-I Digital Experiments - FPGA BASED EXPERIMENTS: (24 Periods)

1. Design and simulation of Full adder and full subtractor
2. Design and simulation of multiplexer, Decoder and 4 bit comparator
3. Design and simulation of 8 bit adder
4. HDL based design entry and simulation of Ripple counter, synchronous counter and BCD counter
5. Design and simulation of simple state machines
6. 4 bit multiplier design and simulation using HDL

7. Compare pre synthesis and post synthesis simulation for experiments 1 to 6 Requirements: Xilinx ISE/Altera Quartus/ equivalent EDA Tools along with Xilinx/Altera/equivalent FPGA Boards.

Part-II Digital Circuit Design (24 Periods)

8. Design and simulate a CMOS inverter using digital flow
9. Design and simulate a CMOS Basic Gates & Flip-Flops
10. Design and simulate a 4-bit synchronous counter using a Flip-Flops
11. Manual/Automatic Layout Generation and Post Layout Extraction for experiments 7 to 9
12. Analyze the power, area and timing for experiments 7 to 9 by performing Pre Layout and Post Layout Simulations**.**

Part-III Analog Circuit Design (12 Periods)

13. Design and Simulate a CMOS Inverting Amplifier.
14. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers.
15. Analyze the input impedance, output impedance, gain and bandwidth for experiments 10 and 11 by performing Schematic Simulations.
16. Design and simulate simple 5 transistor differential amplifier. Analyze Gain, Bandwidth and CMRR by performing Schematic Simulations.
17. Requirements: Cadence/Synopsis/ Mentor Graphics/Tanner/equivalent EDA Tools

TOTAL HOURS: 60

COURSE OUTCOME(S):

CO608. 1 Write HDL code for basic as well as advanced digital integrated circuit

CO608. 2 Ability to implement digital circuits in FPGA using HDL

CO608. 3 Ability to realize digital circuits satisfying timing and area constraints

CO608. 4 Ability to Synthesize, Place and Route the digital IPs

CO608. 5 Ability to design, simulate and extract the layout of Analog IC Blocks using EDA tools

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO801	2											
CO802	3	3	1	1								
CO803	1	2	2	2							1	1
CO804		1	3	3	1						1	1
CO805	3	3	3	3	1						1	1

1→Low 2→Medium 3→High

19GE6M02 INTELLECTUAL PROPERTY RIGHTS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give an idea about IPR, registration and its enforcement.

PRE-REQUISITE:

- Technical Communication

UNIT I INTRODUCTION **6**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Inventions and Innovations – Important examples of IPR.

UNIT II SYSTEM PARTITIONING **6**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications

UNIT III AGREEMENTS AND LEGISLATIONS **6**

Conventions on IPRs, TRIPS Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW **6**

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection, Case Studies.

UNIT V ENFORCEMENT OF IPR **6**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL HOURS: 30

TEXT BOOK(S):

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, ―Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002.

REFERENCE BOOK(S):

1. Deborah E. Bouchoux, ―Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets‖, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,‖Intellectual Property Rights: Unleashing the Knowledge Economy‖, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

WEB RESOURCE(S):

- https://nptel.ac.in/courses/110/105/110105139/

COURSE OUTCOME(S):

CO802-6. 1 Understand the concept of Intellectual Property.

CO802-6. 2 Learn the registration process of Intellectual Property.

CO802-6. 3 Learn the agreements and legislations of Intellectual Property.

CO802-6. 4 Understand the digital products and law in Intellectual Property.

CO802-6. 5 Ability to manage Intellectual Property portfolio to enhance the value of the firm.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO601						2		3	2	3	3	3

CO602						2		3	2	3	3	3
CO603						2		3	2	3	3	3
CO604						2		3	2	3	3	3
CO605						2		3	2	3	3	3

1→Low 2→Medium 3→High

SEVENTH SEMESTER							
Code No.	**Course**	**Category**	**L**	**T**	**P**	**C**	**H**
19EC7101	Principles of Management	HSS	3	0	0	3	3
19EC7601	Microwave Engineering and Measurements	PC	3	0	0	3	3
19EC7602	Wireless Communication Systems	PC	3	0	0	3	3
	Professional Elective – VI	PE	3	0	0	3	3
	Professional Elective – VII	PE	3	0	0	3	3
	Open Elective III	OE	3	0	0	3	3
19EC7611	Advanced Communication Laboratory	PC	0	0	4	2	4
19EC7612	Embedded And Internet Of Things Laboratory	PC	0	0	4	2	4
		TOTAL	**18**	**0**	**8**	**22**	**26**

19EC7101 PRINCIPLES OF MANAGEMENT L T P C

3 0 0 3

OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions andprinciples of management and to learn the application of the principles in an organization.

PRE-REQUISITE:

- Technical Communication

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers -managerial roles and skills – Evolution of Management – Scientific, human relations, system andcontingency approaches – Types of Business organization - Sole proprietorship, partnership,company-public and private sector enterprises - Organization culture and Environment – Currenttrends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – planning process – types of planning – objectives – settingobjectives – policies – Planning premises – Strategic Management – Planning Tools andTechniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart – organizationstructure – 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 planningand management

UNIT IV DIRECTING 9

Foundations of individual and group behaviour – motivation – motivation theories – motivationaltechniques – job satisfaction – job enrichment – leadership – types and theories of leadership –communication – process of communication – barrier in communication – effective communication– communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – budgetary and non-budgetary control techniques – use ofcomputers and IT in Management control – Productivity problems and management – controlandperformance – direct and preventive control – reporting.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Stephen P. Robbins & Mary Coulter, ―Management‖, Prentice Hall (India) Pvt. Ltd., 10th Edition,2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert ―Management‖, Pearson Education, 6th Edition, 2004.

REFERENCE BOOK(S):

1. Stephen A. Robbins & David A. Decenzo& Mary Coulter, ―Fundamentals of ManagementPearson Education, 7th Edition, 2011.
2. Robert Kreitner& Mamata Mohapatra, ― Management‖, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich ―Essentials of management‖ Tata McGraw Hill, 1998.
4. Tripathy PC & Reddy PN, ―Principles of Management‖, Tata McGraw Hill, 1999

COURSE OUTCOME(S):

CO701. 1 Understand the concepts related to Business.

CO701. 2 Assess managerial practices and choices relative to ethical principles and standards.

CO701. 3 Demonstrate the roles, skills and functions of management.

CO701. 4 Describe the barriers to individual decision-making and common styles of decision-making.

CO701. 5 Explain what control means in a business setting and why it is needed.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101						2		2	3	3	3	3
CO102						2		2	3	3	3	3
CO103						2		2	3	3	3	3
CO104						2		2	3	3	3	3
CO105						2		2	3	3	3	3

1→Low 2→Medium 3→High

19EC7601 MICROWAVE ENGINEERING AND MEASUREMENTS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study Passive microwave components and their S- Parameters.
- To study Microwave semiconductor devices & applications.
- To study Microwave tubes and its applications
- To deal with the microwave generation and microwave measurement techniques
- To deal with the issues in the design of microwave amplifier.

PRE-REQUISITE:

- Transmission Lines and Antennas

UNIT I MICROWAVE PASSIVE COMPONENTS 9

Microwave frequency range, significance of microwave frequency range - applications of microwaves- Scattering Matrix-Microwave junctions - Tee junctions -Magic Tee - Rat race - Corners - bends and twists - Directional couplers - two hole directional couplers- Ferrites - important microwave properties and applications – Termination - Gyrator- Isolator-Circulator - Attenuator - Phase changer – S Matrix for microwave components.

UNIT II MICROWAVE SEMICONDUCTOR DEVICES 9

Microwave semiconductor devices- operation - characteristics and application of BJTs and FETs - Principles of tunnel diodes - Varactor and Step recovery diodes – Transferred Electron Devices -Gunn diode- Avalanche Transit time devices- IMPATT and TRAPATT devices. Parametric devices -Principles of operation - applications of parametric amplifier .Microwave monolithic integrated circuit (MMIC) - Materials and fabrication techniques

UNIT III MICROWAVE TUBES 9

Review of conventional vacuum Triodes, Tetrodes and Pentodes, High frequency effects in vacuum Tubes, Theory and application of Two cavity Klystron Amplifier, Reflex Klystron oscillator, Traveling wave tube amplifier, and Magnetron oscillator using Cylindrical, Linear, Coaxial Voltage tunable Magnetrons, Backward wave Crossed field amplifier and oscillator.

UNIT IV MICROWAVE MEASUREMENTS 9

Measuring Instruments : Principle of operation and application of VSWR meter, Power meter, Spectrum analyzer, Network analyzer, Measurement of Impedance, Frequency, Power, VSWR, Q factor, Dielectric constant, Scattering coefficients, Attenuation, S-parameters.

UNIT V MICROWAVE AMPLIFIER AND OSCILLATOR DESIGN 9

Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design

TOTAL HOURS: 45

TEXT BOOK(S):

1. David M. Pozar, "Microwave Engineering", Wiley India (P) Ltd, New Delhi, 2013.
2. Thomas H Lee, "Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits", Cambridge University Press, 2004.
3. Robert E Colin, "Foundations for Microwave Engineering", John Wiley & Sons Inc, 2005
4. Annapurna Das and Sisir K Das, "Microwave Engineering", Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2005
5. M.M.Radmanesh, RF & Microwave Electronics Illustrated, Pearson Education, 2007.

WEB RESOURCE(S):

- https://onlinecourses.nptel.ac.in/noc19_ee57/unit?unit=5&lesson=6
- https://onlinecourses.nptel.ac.in/noc19_ee57/unit?unit=35&lesson=37
- https://onlinecourses.nptel.ac.in/noc19_ee57/unit?unit=55&lesson=56
- https://onlinecourses.nptel.ac.in/noc19_ee57/unit?unit=65&lesson=70

COURSE OUTCOME(S):

CO702. 1 Explain the active & passive microwave devices & components used in Microwave communication systems.

CO702. 2 Measure and analyze Microwave Semiconductor Devices.

CO702. 3 Design and assess the performance of various Microwave tubes

CO702. 4 Design a microwave measurements given the application specifications

CO702. 5 Generate Microwave signals and design microwave amplifiers.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	3	3	3	2							3
CO202	3	3	3	2	2	1						3
CO203	3	3	3	2	2	2						3
CO204	3	3	3	2	2	2	2					3
CO205	3	3	3	1	1	2	3					3

1→Low 2→Medium 3→High

19EC6702 WIRELESS COMMUNICATION SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the cellular concepts and mathematical model of wireless channel.
- To determine the capacity of wireless systems in Rayleigh fading and frequency selective fading environments.
- To find the BER performance and to apply the concept of MIMO to mitigate fading.
- To understand the structures of receiver and receive diversity.
- To analyze the performance of OFDM based wireless communication systems in fading environment.

PRE-REQUISITE:

- Analog and Digital Communication

UNIT I WIRELESS FUNDAMENTALS 9

Cellular concept, Path loss and shadowing: Radio Wave Propagation, Transmit and Receive Signal Models, Free-Space Path Loss, Ray Tracing, Empirical Path Loss Models, Simplified Path Loss Model, Shadow Fading, Combined Path Loss and Shadowing

UNIT II STATISTICAL MULTIPATH MODELS AND CAPACITY ANALYSIS 9

Time-Varying Channel Impulse Response, Narrowband Fading Models, Wideband Fading Models Capacity Analysis: Capacity of Flat fading Channels, Channel and system model, Channel Distribution Information (CDI) Known, Channel Side Information at Receiver, Channel Side Information at transmitter and receiver, Capacity of frequency selective fading Channels, Time Invariant Channels, Time varying Channels

UNIT III BER ANALYSIS AND TRANSMIT DIVERSITY 9

Digital Modulation and Detection: Signal Space analysis, Pass band modulation principles, Amplitude and Phase Modulation, Frequency modulation, Pulse shaping, Error probability analysis in fading channels, Transmit Diversity: Channel known at transmitter, Channel unknown at transmitter- Alamouti scheme

UNIT IV RECEIVER STRUCTURES AND RECEIVE DIVERSITY 9

Maximum Likelihood Receiver, Zero forcing receiver, Minimum Mean Square Error Receiver, V-BLAST Receiver ,Receive Diversity: Selection combining, Equal Gain combining, Threshold Combining, Maximal Ratio Combining, Spatial Multiplexing in MIMO, Moment Generating functions in diversity analysis

UNIT V MULTI CARRIER MODULATION 9

Multi carrier concept, Orthogonal Frequency Division Multiplexing (OFDM) basics, Multiple access for OFDM systems, Orthogonal Frequency Division Multiple Access (OFDMA), Single Carrier Frequency Division Multiple Access (SCFDMA).

TOTAL HOURS: 45

TEXT BOOK(S):

1. Andrea Goldsmith, " Wireless Communications", Cambridge University Press, 2005
2. Aditya.K.Jegannatham, "Principles of Modern Wireless Communication Systems", Tata McGraw Hill, 2016.

REFERENCE BOOK(S):

5. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communications", Cambridge University Press, 2006.
6. Rias Muhamed, Jeffrey G.Andrews, Jun Zhang, Arunaba Ghosh, "Fundamentals of LTE", Prentice Hall, 2010.
7. A.Paulraj, R. Nabar and D Gore, "Introduction to Space-Time Wireless Communications", Cambridge University Press, 2003.
8. John G. Proakis, "Digital Communications", McGraw Hill, 2000.

WEB RESOURCE(S):

1. https://nptel.ac.in/courses/117/102/117102062/
2. https://nptel.ac.in/courses/117/105/117105132/
3. https://nptel.ac.in/courses/117/105/117105132/
4. https://nptel.ac.in/courses/117/105/117105132/
5. https://nptel.ac.in/courses/117/105/117105132/

COURSE OUTCOME(S):

CO703. 1 Describe the cellular concept of Wireless Communication Systems.

CO703. 2 Describe the Mathematical model of a wireless channel

CO703. 3 Determine the capacity of wireless systems in Rayleigh Fading and frequency selective fading environments

CO703. 4 Determine the BER performance of digital modulation schemes in fading environment and Apply the concept of MIMO to mitigate fading effect in wireless communication systems

CO703. 5 Determine the performance of OFDM Based wireless communication systems in fading environment and analyse the performance of given wireless communication systems.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	2	1							1	1		
CO302	3	2	1						1	1		
CO303	3	2	1		2				1	1		
CO304	3	2	2		2				1	1		
CO305	3	2	2	1	1				1	1		

1→Low 2→Medium 3→High

19EC7611 ADVANCED COMMUNICATION LABORATORY L T P C

0 0 4 2

OBJECTIVES:

- Understand the working principle of optical sources, detector, fibers and simple optical Communication link
- To gain information on OTDR and various amplifier characteristics.
- Understand the measurement of BER, Pulse broadening
- Understand and capture an experimental approach to digital wireless communication
- Understand actual communication waveforms that will be sent and received across wireless channel and experiment using CST microwave studio.

PRE-REQUISITE:

- Analog and Digital Communication Laboratory

LIST OF OPTICAL EXPERIMENTS

1. Measurement of connector, bending and fiber attenuation losses.
2. Numerical Aperture and Mode Characteristics of Fibers.

3. Fiber optic Analog and Digital Link Characterization - frequency response (analog), eye diagram and BER (digital)
4. Optical time domain reflectometer
5. Experiments with optical simulation tool Optisim -Optical Amplifiers Characterisation (SBS, SRS, Rare Earth doped Fibers), Characterisation Of Optical Cross connects

LIST OF WIRELESS COMMUNICATION EXPERIMENTS

1. Wireless Channel Simulation including fading and Doppler effects
2. Simulation of Channel Estimation, Synchronization & Equalization techniques
3. Analysing Impact of Pulse Shaping and Matched Filtering using Software Defined Radios
4. OFDM Signal Transmission and Reception using Software Defined Radios

LIST OF MICROWAVE EXPERIMENTS

1. VSWR and Impedance Measurement and Impedance Matching
2. Characterization of Directional Couplers, Isolators, Circulators
3. Gunn Diode Characteristics,Relex Klystron Characteristics
4. Microwave IC – Filter Characteristics
5. Experiments using CST Microwave studio

TOTAL HOURS: 60

COURSE OUTCOME(S):

CO707. 1 Students will be able to Analyze the performance of simple optical link.

CO707. 2 Analyze the performance of OTDR and Optical amplifier characteristics

CO707. 3 Analyze the Eye Pattern, Pulse broadening of optical fiber and the impact on BER.

CO707. 4 Estimate the Wireless Channel Characteristics and Analyze the performance of Wireless Communication System.

CO707. 5 Understand the intricacies in Microwave System design using CST microwave studio.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO701	3	3	3	3	3	3				3	3	3
CO702	3	2	3	3	3	3					3	3
CO703	3	2	3	3	3	3					3	3
CO704	3	3	2	3	3	3					3	3
CO705	3	3	3	3	3	3					2	3

1→Low 2→Medium 3→High

19EC7612 EMBEDDED AND INTERNET OF THINGS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

1. To develop skills to work with various modules in embedded processors.
2. To work with various sensors and actuators.
3. To create IoT dashboards using various cloud servers

PRE-REQUISITE:

- Microprocessor and microcontroller lab

Laboratory Experiments

1. Study and Install IDE of Arduino
2. Write program using Arduino IDE
   - Blinking LEDs
   - Hardware and software delay
3. Study the Sensor and Write Program for monitoring the sensor parameters using Arduino
   - Humidity/ Temperature sensor
   - PIR Sensor & Ultrasonic sensor
   - DC, Servo motor interfacing and Relays
4. Embedded System design using MSP 430 Microcontroller.
   - Humidity/ Temperature sensor
   - PIR Sensor & Ultrasonic sensor
   - DC and Servo motor interfacing
5. Embedded System design using Energia IDE with CC3200.
6. Study of ARM CORTEX M4
   - Flashing of LEDS.
   - Interfacing keyboard and LCD.
7. Study and implementation of various wireless communication protocols such as ZigBee, Bluetooth, RF, NFC etc.,
8. Study and Configure Raspberry Pi.
9. WAP for LED blink using Raspberry Pi.
10. Creation of own Web Server and Web page for Monitoring and control applications.
11. Study and implement MQTT protocol using Arduino and Raspberry pi
12. Exercises on cloud application using Thing speak cloud server.
13. Exercises on Cloud application using Ad fruit cloud.
14. Exercises on Cloud application using IBM cloud.
15. Creating an IoT dashboard using Cayenne project builder.

TOTAL HOURS: 60

COURSE OUTCOME(S):

CO708. 1 Interface Embedded Processors with I/O devices

CO708. 2 Design an embedded system using Arduino and MSP 430.

CO708. 3 Design ARM based wireless Embedded systems.

CO708. 4 Designing Embedded Systems using CC3200 Launch pad.

CO708. 5 Design IoT Application using various cloud server.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO801	3	3	3	3		3					3	3

CO802	3	3	3	3		3					3	3
CO803	3	3	3	3		3					3	3
CO804	3	3	3	3		3					3	3
CO805	3	3	3	3		3					2	3

1→Low 2→Medium 3→High

PROFESSIONAL ELECTIVES						
Code No.	**Course**	**L**	**T**	**P**	**C**	**H**
SEMESTER V- PROFESSIONAL ELECTIVE-I						
19EC5701	Medical Electronics	3	0	0	3	3
19EC5702	Communication Networks	3	0	0	3	3
19EC5703	Web Technology	3	0	0	3	3
19EC5704	Real Time System Analysis and Design	3	0	0	3	3
19EC5705	Computational Intelligence	3	0	0	3	3
SEMESTER V- PROFESSIONAL ELECTIVE-II						
19EC5706	Speech and Analytical processing	3	0	0	3	3
19EC5707	Avionics	3	0	0	3	3
19EC5708	Solid State Devices	3	0	0	3	3
19EC5709	Information Theory And Coding Techniques	3	0	0	3	3
19EC5710	Computer Architecture And Organization	3	0	0	3	3
SEMESTER VI- PROFESSIONAL ELECTIVE-III						
19EC6701	Wireless Networks	3	0	0	3	3
19EC6702	Measurement and Instrumentation	3	0	0	3	3
19EC6703	Advanced Microprocessors and Microcontrollers	3	0	0	3	3
19EC6704	Deep Learning	3	0	0	3	3
19EC6705	Network Cryptographic Techniques	3	0	0	3	3
SEMESTER VI- PROFESSIONAL ELECTIVE-IV						
19EC6706	DSP Architecture	3	0	0	3	3
19EC6707	Ad hoc and Wireless Sensor Networks	3	0	0	3	3
19EC6708	Electronic Testing and Packaging	3	0	0	3	3
19EC6709	Sensors and Transducers	3	0	0	3	3
19EC6710	Satellite Communication	3	0	0	3	3
SEMESTER VI- PROFESSIONAL ELECTIVE-V						
19EC6711	Embedded System Design	3	0	0	3	3
19EC6712	Fibre optic Networks	3	0	0	3	3
19EC6713	4G & 5G Networks	3	0	0	3	3
19EC6714	OFDM Systems	3	0	0	3	3
19EC6715	Radar and Navigational Aids	3	0	0	3	3

PROFESSIONAL ELECTIVES						
Code No.	**Course**	**L**	**T**	**P**	**C**	**H**
SEMESTER VII- PROFESSIONAL ELECTIVE-VI						
19EC7701	Opto Electronic Devices	3	0	0	3	3
19EC7702	CMOS Analog IC Design	3	0	0	3	3
19EC7703	Digital Image Processing and Pattern Recognition	3	0	0	3	3
19EC7704	Cognitive Radio	3	0	0	3	3
19EC7705	Blockchain Principles	3	0	0	3	3
SEMESTER VII- PROFESSIONAL ELECTIVE-VII						
19EC7706	Internet of Things	3	0	0	3	3
19EC7707	Advanced Digital Signal Processing	3	0	0	3	3
19EC7708	Lowpower SOC	3	0	0	3	3
19EC7709	MEMS and NEMS	3	0	0	3	3
19EC7710	High Speed Communication Networks	3	0	0	3	3
SEMESTER VIII- PROFESSIONAL ELECTIVE-VIII						
19EC8701	Multimedia Compression And Communication	3	0	0	3	3
19EC8702	Telecommunication And Switching Network Systems	3	0	0	3	3
19EC8703	Mobile Communications	3	0	0	3	3
19EC8704	Embedded Networks	3	0	0	3	3
19EC8705	ASIC Design	3	0	0	3	3

19EC5701 MEDICAL ELECTRONICS L T P C
3 0 0 3

OBJECTIVES:

- To gain knowledge about the various physiological parameters and methods of recording and measuring.
- To study about the various assist devices used in the hospitals
- To gain knowledge about equipment used for physical medicine and
- To gain knowledge about the various recently developed diagnostic and therapeutic techniques.

PRE-REQUISITE:

- Fundamentals Of Computational Biology

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9

Sources of biomedical signals, Bio-potentials, Biopotential electrodes, ECG, EEG, EMG-recorders, typical waveforms and signal characteristics

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT 9

pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, Respiratory, Blood pressure, Temperature and Pulse measurement, Blood Cell Counters.

UNIT III ASSIST DEVICES 9

Cardiac pacemakers, DC Defibrillator, Dialyser, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY 9

Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION 9

Telemedicine, Insulin Pumps, Radio pill, Robotic surgery, Brain machine interface, Lab on a chip.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2007.

REFERENCE BOOK(S):

1. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TATA Mc Graw-Hill, Third edition, New Delhi, 2014.
2. John G.Webster, “Medical Instrumentation Application and Design”, 3rd Edition, Wiley India Edition, 2007
3. Joseph J.Carr and John M.Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and Sons, New York, 2004.

COURSE OUTCOME(S):

CO504-1. 1 Know the human body electro- physiological parameters and recording of bio-

potentials.

CO504-1. 2 Comprehend the non-electrical and biochemical physiological parameters and their measurement.

CO504-1. 3 Know the working of various diagnostic and therapeutic assist devices used in the hospitals.

CO504-1. 4 Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies and bio-telemetry principles and methods

CO504-1. 5 Know about recent trends in medical instrumentation.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	3			2	3	2	3		2	2		3
CO102	3			2	3	2	3		2	2		3
CO103	3			2	3	2	3		2	2		3
CO104	3			2	3	2	3		2	2		3
CO105	3			2	3	2	3		2	2		3

1→Low 2→Medium 3→High

19EC5702 COMMUNICATION NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks.
- Be exposed to the required functionality at each layer.
- Learn the flow control and congestion control algorithms.

PRE-REQUISITE:

- Analog and Digital Communication

UNIT I FUNDAMENTALS & LINK LAYER 9

Overview of Data Communications- Networks – Building Network and its types– Overview of Internet - Protocol Layering - OSI Mode – Physical Layer – Overview of Data and Signals - introduction to Data Link Layer - Link layer Addressing- Error Detection and Correction

UNIT II MEDIA ACCESS & INTERNETWORKING 9

Overview of Data link Control and Media access control - Ethernet (802.3) - Wireless LANs – Available Protocols – Bluetooth – Bluetooth Low Energy – WiFi –Network layer services – Packet Switching – IPV4 Address – Network layer protocols (IP, ICMP, Mobile IP)

UNIT III ROUTING 9

Routing - Unicast Routing – Algorithms – Protocols – Multicast Routing and its basics – Overview of Intradomain and interdomain protocols – Overview of IPv6 Addressing – Transition from IPv4 to IPv6

UNIT IV TRANSPORT LAYER 9

Introduction to Transport layer –Protocols- User Datagram Protocols (UDP) and Transmission Control Protocols (TCP) –Services – Features – TCP Connection – State Transition Diagram – Flow, Error and Congestion Control - Congestion avoidance (DECbit, RED) – QoS – Application requirements

UNIT V APPLICATION LAYER 9

Application Layer Paradigms – Client Server Programming – World Wide Web and HTTP - DNS- Electronic Mail (SMTP, POP3, IMAP, MIME) – Introduction to Peer to Peer Networks – Need for Cryptography and Network Security – Firewalls.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Behrouz A. Forouzan, "Data communication and Networking", Fifth Edition, Tata McGraw – Hill, 2013.
2. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", Seventh Edition, Pearson Education, 2016.

REFERENCE BOOK(S):

1. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2nd Edition, 2014.
2. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", Mc Graw Hill Publisher, 2011.
3. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.

COURSE OUTCOME(S):

CO504-2. 1 Identify the components required to build different types of networks

CO504-2. 2 Choose the required functionality at each layer for given application.

CO504-2. 3 Identify solution for each functionality at each layer.

CO504-2. 4 Trace the flow of information from one node to another node in the network.

CO504-2. 5 Identify the application of communication Network.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	2	1	1	1						1	1
CO202	3	2	1	1	1						1	1
CO203	3	2	1	1	1						1	1
CO204	3	2	1	1	1						1	1
CO205	3	2	1	1	1						1	1

1→Low 2→Medium 3→High

19EC6703 WEB TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To learn Markup languages and Style Sheets for web design.
- To familiarize with Client-Side Programming and host objects.
- To explore Client-Side Programming and Server-Side Programming.
- To discover the use of XML.
- To learn about web services and create web services.

PRE-REQUISITE:

- Fundamentals of Data Structure and OOPS

UNIT I WEB ESSENTIALS AND MARKUP LANGUAGES 9

Web Essentials - Clients – Servers – Communication - The Internet - Basic Internet Protocols –World Wide Web - HTTP Request Message - Response Message - Web Clients - Browsers - Web Servers Markup Languages – HTML History and Versions - HTML Elements - Relative URLs – Lists – Tables – Frames – Forms – HTML5 Elements

UNIT II STYLE SHEETS AND CLIENT-SIDE PROGRAMMING 9

Style Sheets - Cascading Style Sheets – Features - Core Syntax - Style Sheets and HTML - Style Rule - Text Properties - Box Model - Normal Flow Box Client-Side Programming - JavaScript Language - History and Versions - JavaScript in Perspective – Syntax - Variables and Data Types – Statements – Operators – Literals – Functions – Objects – Arrays - Built-in Objects

UNIT III HOST OBJECTS AND SERVER-SIDE PROGRAMMING 9

Host Objects - Document Object Model - Intrinsic Event Handling - Modifying Element Style - Document Tree - DOM Event Handling - Server-Side Programming - Java Servlets - Architecture - Generating Dynamic Content – Life Cycle - Parameter Data – Sessions - Cookies - URL Rewriting - Other Servlet Capabilities - Data Storage - Servlets and Concurrency - Case Study

UNIT IV SEPARATING PROGRAMMING AND PRESENTATION AND REPRESENTING WEB DATA 9

Separating Programming and Presentation - Presentation tier using JSP - JSP and Servlets - Support for the Model-View Controller Paradigm - Case Study - Representing Web Data - XML - Documents and Vocabularies - Versions and Declaration - Namespaces - JavaScript and XML - Displaying XML Documents in Browsers - Case Study

UNIT V WEB SERVICES 9

Web Services Building Blocks - SOAP - SOAP Syntax - Sending SOAP messages - SOAP Implementations - Future of SOAP - Web Services Building Blocks - WSDL and UDDI - WSDL Syntax - SOAP Binding -Other Bindings - UDDI - UDDI API – The Future of UDDI

TOTAL HOURS: 45

TEXT BOOK(S):

1. Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2012.
2. Ron Schmelzer et al. “XML and Web Services Unleashed” SAMS,2002

REFERENCE BOOK(S):

1. Mark Pilgrim, “HTML5: Up and Running”, O’Reilly, 2012.
2. Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, Seventh Edition, 2012.
3. H.M.Deitel, P.J.Deitel, Goldberg, "Internet & World Wide Web How To Program", Pearson Education, Third Edition, 2006.
4. Marty Hall and Larry Brown, “Core Web Programming”, Volume I and II, Pearson Education, Second Edition, 2010.
5. Bates, “Developing Web Applications”, Wiley, 2008.

COURSE OUTCOME(S):

CO504-3. 1 Design web pages using Markup languages and Cascading Style Sheets

CO504-3. 1 Implement Client-Side Programming using Java Script and DOM

CO504-3. 2 Use web platform for information sharing with Servlets and JSP

CO504-3. 3 Use XML Technologies

CO504-3. 4 Develop Web Services for Online communities in the Business World

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	3	3	3	3	3						2	2
CO302	3	3	3	3	3						2	2
CO303	3	3	3	3	3						2	2
CO304	3	3	3	3	3						2	2
CO305	3	3	3	3	3						2	2

1→Low 2→Medium 3→High

19EC5704 REAL TIME SYSTEM ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the embedded system fundamentals
- To implement various scheduling algorithms
- To Learn various elements of embedded systems
- To design a Real time embedded systems
- To understand the various software development tools

PRE-REQUISITE:

- C Programming.

UNIT I INTRODUCTION 9

Characteristics of embedded systems and challenges in system design –design issues in embedded real-time systems, critical performance issues in embedded real-time systems. Software builds process-infinite loop process, compiling, linking & locating. Software porting issues on target hardware-Firmware/ device driver writing in c/c++/ assembly language, flashing the LED, program initialization, serial ports communication. Code optimization – increasing code efficiency, decreasing code size, reducing memory usage, limiting the usage of c++

UNIT II SURVEY OF SOFTWARE ARCHITECTURES 9

Round –robin, round-robin with interrupts, queues. Function- scheduling architecture, real time operating system architecture, scheduling architecture.

UNIT III ELEMENTS OF REAL TIME OPERATING SYSTEMS 9

Tasks & task states, tasks & data, semaphores & shares data, message queues, mailboxes and pipes, timer functions, events, memory management and interrupt routines in an RTOS environment.

UNIT IV BASIC DESIGN USING REAL-TIME OPERATING SYSTEMS 9

Principles, encapsulating semaphores & queues, hard real-time scheduling considerations, saving memory space, saving power.

UNIT V EMBEDDED SOFTWARE DEVELOPMENT TOOLS 9

Host and target machines, linker/locators for embedded software, getting embedded software into the target system. Debugging techniques- testing on host system, instruction set simulators, the assert, macro using laboratory tools.

TOTAL HOURS: 45

TEXT BOOK(S):

1. David e. Simon, “an embedded software primer”, Pearson education, 2002.

REFERENCE BOOK(S):

1. Arnold s. Berger, “embedded systems design- an introduction to processes, tools & techniques “, CMP books, 2002.
2. Jean j. Labrosse, “embedded systems building blocks”, CMP books, 2002.
3. Michael Barr, “programming embedded systems in c and c++”, O’Reilly, 1999.
4. Wayne wolf, “computers as components- principles of embedded computing systems design”, academic press, 2001.

WEB RESOURCE(S):

1. https://www.coursera.org/lecture/real-time-systems/rtos-overview-RIAFe
2. https://www.arm.com/resources/education/online-courses/real-time-operating-systems

COURSE OUTCOME(S):

CO504-4. 1	Design systems with high optimization and efficiency
CO504-4. 2	Use appropriate scheduling algorithms for designing a system.
CO504-4. 3	Design operating system with queues, semaphores, pipes.
CO504-4. 4	Design system with real time operating systems.

CO504-4. 5 Debug the errors in existing systems.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO401	3	3	3	3	2						1	1
CO402	3	3	3	3	2						1	1
CO403	3	3	3	3	2						1	1
CO404	3	3	3	3	2						1	1
CO405	3	3	3	3	2						1	1

1→Low 2→Medium 3→High

19EC5705 COMPUTATIONAL INTELLIGENCE L T P C
3 0 0 3

OBJECTIVES:

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

PRE-REQUISITE:

- Python Programming

UNIT I INTRODUCTION 9

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems

UNIT II PROBLEM SOLVING METHODS 9

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games.

UNIT III KNOWLEDGE REPRESENTATION 9

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information

UNIT IV SOFTWARE AGENTS 9

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

UNIT V APPLICATIONS 9

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

TOTAL HOURS: 45

TEXT BOOK(S):

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009.
2. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011

REFERENCE BOOK(S):

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.
4. Gerhard Weiss, "Multi Agent Systems", Second Edition, MIT Press, 2013.
5. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2010.

WEB RESOURCE(S):

1. https://www.coursera.org/courses?query=artificial%20intelligence
2. https://www.edx.org/learn/artificial-intelligence
3. https://www.udemy.com/topic/artificial-intelligence/

COURSE OUTCOME(S):

CO504-5. 1 Use appropriate search algorithms for any AI problem.
CO504-5. 2 Represent a problem using first order and predicate logic.
CO504-5. 3 Provide the apt agent strategy to solve a given problem.
CO504-5. 4 Design software agents to solve a problem.
CO504-5. 5 Design applications for NLP that use Artificial Intelligence.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO501	3	3	3	2	1						1	1
CO502	3	3	3	2	1						1	1
CO503	3	3	3	2	2						1	1
CO504	3	3	3	3	3						1	1
CO505	3	3	3	3	3						1	1

1→Low 2→Medium 3→High

19EC5706 SPEECH AND ANALYTICAL PROCESSING L T P C

3 0 0 3

OBJECTIVES:

- To introduce speech production and related parameters of speech.

- To illustrate the concepts of speech signal representations and coding.
- To understand different speech modeling procedures such Markov and their implementation issues.
- To gain knowledge about text analysis and speech synthesis.

PRE-REQUISITE:

- Discrete Time Signal Processing

UNIT I FUNDAMENTALS OF SPEECH PROCESSING 9

Introduction – Spoken Language Structure – Phonetics and Phonology – Syllables and Words – Syntax and Semantics – Probability, Statistics and Information Theory – Probability Theory – Estimation Theory – Significance Testing – Information Theory.

UNIT II SPEECH SIGNAL REPRESENTATIONS AND CODING 9

Overview of Digital Signal Processing – Speech Signal Representations – Short time Fourier Analysis – Acoustic Model of Speech Production – Linear Predictive Coding – Cepstral Processing – Formant Frequencies – The Role of Pitch – Speech Coding – LPC Coder, CELP, Vocoders.

UNIT III SPEECH RECOGNITION 9

Hidden Markov Models – Definition – Continuous and Discontinuous HMMs – Practical Issues – Limitations. Acoustic Modeling – Variability in the Speech Signal – Extracting Features – Phonetic Modeling – Adaptive Techniques – Confidence Measures – Other Techniques.

UNIT IV TEXT ANALYSIS 9

Lexicon – Document Structure Detection – Text Normalization – Linguistic Analysis – Homograph Disambiguation – Morphological Analysis – Letter-to-sound Conversion – Prosody – Generation schematic – Speaking Style – Symbolic Prosody – Duration Assignment – Pitch Generation

UNIT V SPEECH SYNTHESIS 9

Attributes – Formant Speech Synthesis – Concatenative Speech Synthesis – Prosodic Modification of Speech – Source-filter Models for Prosody Modification – Evaluation of TTS Systems.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Ben Gold and Nelson Morgan, “Speech and Audio Signal Processing, Processing and Perception of Speech and Music”, Wiley- India Edition, 2006
2. Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, John Wiley and Sons, 1999.

REFERENCE BOOK(S):

1. Ben Gold and Nelson Morgan, “Speech and Audio Signal Processing, Processing and Perception of Speech and Music”, Wiley- India Edition, 2006
2. Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, John Wiley and Sons, 1999.
3. Daniel Jurafsky and James H Martin, “Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson Education, 2002.

4. Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997.
5. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
6. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education, 2004.

COURSE OUTCOME(S):

CO505-1. 1 Model speech production system and describe the fundamentals of speech.

CO505-1. 2 Extract and compare different speech parameters.

CO505-1. 3 Choose an appropriate statistical speech model for a given application.

CO505-1. 4 Design a speech recognition system.

CO505-1. 5 Use different text analysis and speech synthesis techniques.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	3	2	2	2	1	2		1	1		3	3
CO102	3	2	2	1	1	2		1	1		3	3
CO103	3	2	2	1	1	2		1	1		3	3
CO104	3	3	3	2	1	2		1	1		3	3
CO105	3	2	1	1	1	2		1	1		3	3

1→Low 2→Medium 3→High

19EC5707 AVIONICS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basic of avionics and its need for civil and military aircrafts.
- To impart knowledge about the avionic architecture and various avionics data buses.
- To gain more knowledge on various avionics subsystems.

PRE-REQUISITE:

- Analog Electronics

UNIT I INTRODUCTION TO AVIONICS 9

Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon systems – typical avionics subsystems, design, technologies – Introduction to digital computer and memories.

UNIT II DIGITAL AVIONICS ARCHITECTURE 9

Avionics system architecture – data buses – MIL-STD-1553B – ARINC – 420 – ARINC – 629.

UNIT III FLIGHT DECKS AND COCKPITS 9

Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

UNIT IV INTRODUCTION TO NAVIGATION SYSTEMS 9

Radio navigation – ADF, DME, VOR, LORAN, DECCA, OMEGA, ILS, MLS – Inertial Navigation Systems (INS) – Inertial sensors, INS block diagram – Satellite navigation systems – GPS.

UNIT V AIR DATA SYSTEMS AND AUTO PILOT 9

Air data quantities – Altitude, Air speed, Vertical speed, Mach Number, Total air temperature, Mach warning, Altitude warning – Auto pilot – Basic principles, Longitudinal and lateral auto pilot.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Albert Helfrick.D., "Principles of Avionics", Avionics Communications Inc., 2009
2. Collinson.R.P.G. "Introduction to Avionics", Chapman and Hall, 1996.

REFERENCE BOOK(S):

1. Middleton, D.H., Ed., "Avionics systems, Longman Scientific and Technical", Longman Group UK Ltd., England, 1989.
2. Pallet.E.H.J., "Aircraft Instruments and Integrated Systems", Pearsons, Indian edition 2011.
3. Spitzer, C.R. "Digital Avionics Systems", Prentice-Hall, Englewood Cliffs, N.J.,U.S.A. 1993.
4. Spitzer. C.R. "The Avionics Hand Book", CRC Press, 2000

COURSE OUTCOME(S):

CO505-2. 1 Ability to built Digital avionics architecture

CO505-2. 2 Ability to Design Navigation system

CO505-2. 3 Ability to design and perform analysis on air system.

CO505-2. 4 Integrate avionics systems using data buses.

CO505-2. 5 Analyze the performance of various cockpit display technologies.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	3	3	3	3	2						3
CO202	3	3	3	3	3	3	2					3
CO203	3	3	3	3	3	3	2					3
CO204	3	3	3	3	3	2						3
CO205	3	3	3	3	3	2						3

1→Low 2→Medium 3→High

19EC5708 SOLID STATE DEVICES L T P C

3 0 0 3

OBJECTIVES:

- To make the students understand the fundamentals of solid state devices.
- To train them to apply these devices in most used and important applications.

PRE-REQUISITE:

- Electronic Devices & Circuit Analysis

UNIT I SEMICONDUCTORS AND FABRICATION 9

Semiconductor materials: crystal growth, film formation, lithography, etching and doping. Formation of energy bands in solids, Concept of hole, Intrinsic and extrinsic semiconductors, conductivity, Equilibrium Carrier concentration, Density of states and Fermi level, Carrier transport –continuity equation, Hall effect and its applications.

UNIT II P-N JUNCTION CHARACTERISTICS AND APPLICATIONS 9

P-N junction diodes, Energy band diagram, biasing, V-I characteristics, capacitances. Diode models, Break down Mechanisms, Rectifiers, Limiting and Clamping Circuits, types of diodes.

UNIT III BIPOLAR JUNCTION TRANSISTORS 9

BJT Physics and Characteristics modes of operation, Ebers-Moll Model, BJT as a switch and Amplifier, breakdown mechanisms, Photo devices.

UNIT IV MOSFET CHARACETERISTICS AND MODELS 9

MOSFET: Ideal I-V characteristics, non-ideal I-V effects, MOS Capacitor, MOSFET as switch, CMOS Logic gate Circuits, Bi-CMOS circuits, CCDs.

UNIT V POWER DEVICES 9

Power devices, operation and characteristics. Thyristor family. Power diodes. Power transistors.

TOTAL HOURS: 45

TEXT BOOK(S):

1. S.M.Sze, Semiconductors Devices, Physics and Technology, (8/e), Wiley, 2015
2. A.S.Sedra & K.C.Smith, Microelectronic Circuits (5/e), Oxford, 2004
3. L.Macdonald &A.C.Lowe, Display Systems, Wiley, 2003

REFERENCE BOOK(S):

1. Robert Pierret, “Semiconductor Device Fundamentals,” Pearson Education, 2006
2. J.Millman and C.C.Halkias : Electronic devices and Circuits, McGraw Hill, 1976.
3. B.G.Streetman : Solid state devices, (4/e), PHI, 1995.
4. N.H.E.Weste, D. Harris, “CMOS VLSI Design (3/e)”, Pearson, 2005.

COURSE OUTCOME(S):

CO505-3. 1 Apply the knowledge of basic semiconductor material physics and understand fabrication processes.

CO505-3. 2 Analyze the characteristics of various electronic devices like diode, transistor etc.,

CO505-3. 3 Classify and analyze the various circuit configurations of Transistor and MOSFETs

CO505-3. 4 Illustrate the qualitative knowledge of Power electronic Devices

CO505-3. 5 Become Aware of the latest technological changes in Display Devices

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	3	3	3	3	3							3

CO302	3	3	3	3	2							3
CO303	3	3	3	3	2							3
CO304	3	3	3	2	1							3
CO305	3	3	3	2								3

1→Low 2→Medium 3→High

19EC5709 INFORMATION THEORY AND CODING TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

- Understand error–control coding.
- Understand encoding and decoding of digital data streams.
- Be familiar with the methods for the generation of these codes and their decoding techniques.
- Be aware of compression and decompression techniques.
- Learn the concepts of multimedia communication.

PRE-REQUISITE:

- Analog and Digital Communication

UNIT I INFORMATION ENTROPY FUNDAMENTALS 9

Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.

UNIT II DATA AND VOICE CODING 9

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive subband coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT III ERROR CONTROL CODING 9

Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes.

UNIT IV COMPRESSION TECHNIQUES 9

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards

UNIT V AUDIO AND VIDEO CODING 9

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Simon Haykin, "Communication Systems", 4th Edition, John Wiley and Sons, 2007.
2. Fred Halsall, "Multimedia Communications, Applications Networks Protocols and Standards", Pearson Education, Asia 2002.

REFERENCE BOOK(S):

1. Mark Nelson, "Data Compression Book", BPB Publication 1992.
2. Watkinson J, "Compression in Video and Audio", Focal Press, London, 1995

COURSE OUTCOME(S):

CO505-4. 1 Learn the fundamentals of information fundamentals.

CO505-4. 2 Understand different data and voice coding.

CO505-4. 3 Design an application with error–control.

CO505-4. 4 Use compression and decompression techniques.

CO505-4. 5 Apply the concepts of multimedia communication.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO401	3	3	3	3	3					2	2	2
CO402	3	3	3	3	3					2	2	2
CO403	3	3	3	3	3					2	2	2
CO404	3	3	3	3	3					2	2	2
CO405	3	3	3	3	3					2	2	2

1→Low 2→Medium 3→High

19EC5710 COMPUTER ARCHITECTURE AND ORGANIZATION L T P C
3 0 0 3

OBJECTIVES:

- To make students understand the basic structure and operation of digital computer.
- To familiarize with implementation of fixed point and floating-point arithmetic operations.
- To study the design of data path unit and control unit for processor.
- To understand the concept of various memories and interfacing.
- To introduce the parallel processing technique.

PRE-REQUISITE:

- Digital Electronics

UNIT I COMPUTER ORGANIZATION & INSTRUCTIONS 9

Basics of a computer system: Evolution, Ideas, Technology, Performance, Power wall, Uniprocessors to Multiprocessors. Addressing and addressing modes. Instructions: Operations and Operands, Representing instructions, Logical operations, control operations.

UNIT II ARITHMETIC 9

Fixed point Addition, Subtraction, Multiplication and Division. Floating Point arithmetic, High performance arithmetic, Subword parallelism

UNIT III THE PROCESSOR 9

Introduction, Logic Design Conventions, Building a Datapath - A Simple Implementation scheme - An Overview of Pipelining - Pipelined Datapath and Control. Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions.

UNIT IV MEMORY AND I/O ORGANIZATION 9

Memory hierarchy, Memory Chip Organization, Cache memory, Virtual memory. Parallel Bus Architectures, Internal Communication Methodologies, Serial Bus Architectures, Mass storage, Input and Output Devices.

UNIT V ADVANCED COMPUTER ARCHITECTURE 9

Parallel processing architectures and challenges, Hardware multithreading, Multicore and shared memory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers - Introduction to Multiprocessor network topologies.

TOTAL HOURS: 45

TEXT BOOK(S):

1. David A. Patterson and John L. Hennessey, "Computer Organization and Design", Fifth edition, Morgan Kauffman / Elsevier, 2014.
2. Miles J. Murdocca and Vincent P. Heuring, "Computer Architecture and Organization: An Integrated approach", Second edition, Wiley India Pvt Ltd, 2015

REFERENCE BOOK(S):

1. V. Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organization", Fifth edition, Mc Graw-Hill Education India Pvt Ltd, 2014.
2. William Stallings "Computer Organization and Architecture", Seventh Edition, Pearson Education, 2006.
3. Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", Second edition, McGraw-Hill Education India Pvt Ltd, 2014.

COURSE OUTCOME(S):

CO505-5. 1 Describe data representation, instruction formats and the operation of a digital computer.

CO505-5. 2 Illustrate the fixed point and floating-point arithmetic for ALU operation.

CO505-5. 3 Discuss about implementation schemes of control unit and pipeline performance.

CO505-5. 4 Explain the concept of various memories, interfacing and organization of multiple processors.

CO505-5. 5 Discuss parallel processing technique and unconventional architectures.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO501	3	2	2	2							2	1
CO502	3	3	3	3							2	1
CO503	3	2	3	2							2	1
CO504	3	2	2	2							2	1

CO505	3	2	2	2							2	1

1→Low 2→Medium 3→High

19EC6701 WIRELESS NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- To understand the concept about Wireless networks, protocol stack and standards.
- To understand and analyse the network layer solutions for Wireless networks.
- To study about fundamentals of 3G Services, its protocols and applications.
- To have in depth knowledge on internetworking of WLAN and WWAN.
- To learn about evolution of 4G Networks, its architecture and applications.

PRE-REQUISITE:

- Communication Networks.

UNIT I WIRELESS LAN 9

Introduction-WLAN technologies: - IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN-Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, WirelessHART

UNIT II MOBILE NETWORK LAYER 9

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing: Dynamic source routing, IoT: CoAP

UNIT III 3G OVERVIEW 9

Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA.

UNIT IV INTERNETWORKING BETWEEN WLANS AND WWANS 9

Internetworking objectives and requirements, Schemes to connect WLANS and 3G Networks, Session Mobility, Internetworking Architecture for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System.

UNIT V 4G & BEYOND 9

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education 2012.
2. Vijay Garg, "Wireless Communications and networking", First Edition, Elsevier 2007.

REFERENCE BOOK(S):

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", Second Edition, Academic Press, 2008.
2. Anurag Kumar, D.Manjunath, Joy kuri, "Wireless Networking", First Edition, Elsevier 2011.
3. Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", First Edition, Pearson Education 2013.

COURSE OUTCOME(S):

CO603-1. 1 Design and implement of Wireless LAN.

CO603-1. 2 Conversant with the latest 3G/4G networks and its architecture.

CO603-1. 3 Design and implement wireless network environment for any application using latest wireless protocols and standards.

CO603-1. 4 Ability to select the suitable network depending on the availability and requirement.

CO603-1. 5 Implement different type of applications for smart phones and mobile devices with latest network strategies.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	1	2	3	2			1		2			3
CO102	2	2	1	2			1		1			3
CO103	1	2	3	2			1		2			3
CO104	2	2	1	2			1		2			3
CO105	2	2	1	2			1		1			3

1→Low 2→Medium 3→High

19EC6702 MEASUREMENT AND INSTRUMENTATION L T P C
3 0 0 3

OBJECTIVES:

- To introduce the concept of measurement and the related instrumentation requirement as a vital ingredient of electronics and communication engineering.

PRE-REQUISITE:

- Basic Electrical and Instrumentation Engineering

UNIT I BASIC MEASUREMENT CONCEPTS 9

Measurement systems –Static and dynamic characteristics –units and standards of measurements –error :- accuracy and precision, types, statistical analysis –moving coil, moving iron meters –multimeters –Bridge measurements : –Maxwell, Hay, Schering, Anderson and Wien bridge.

UNIT II BASIC ELECTRONIC MEASUREMENTS 9

Electronic multimeters –Cathode ray oscilloscopes –block schematic –applications –special oscilloscopes:–delayed time base oscilloscopes, analog and digital storage oscilloscope, sampling oscilloscope –Q meters –Vector meters –RF voltage and power measurements –True RMS meters.

UNIT III SIGNAL GENERATORS AND ANALYZERS 9

Function generators –pulse and square wave generators, RF signal generators –Sweep generators – Frequency synthesizer –wave analyzer –Harmonic distortion analyzer –spectrum analyzer :-digital spectrum analyzer, Vector Network Analyzer –Digital L,C,R measurements, Digital RLC meters.

UNIT IV DIGITAL INSTRUMENTS 9

Comparison of analog and digital techniques –digital voltmeter –multimeters –frequency counters – measurement of frequency and time interval –extension of frequency range –Automation in digital instruments, Automatic polarity indication, automatic ranging, automatic zeroing, fully automatic digital instruments, Computer controlled test systems, Virtual instruments.

UNIT V DATA ACQUISITION SYSTEMS AND FIBER OPTIC MEASUREMENT 9

Elements of digital data acquisition system –interfacing of transducers –multiplexing –data loggers – computer controlled instrumentation –IEEE 488 bus –fiber optic measurements for power and system loss –optical time domains reflectometer.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Albert D.Helfrick and William D.Cooper –Modern Electronic Instrumentation and Measurement Techniques, Pearson / Prentice Hall of India, 2007.
2. Ernest O. Doebelin, Measurement Systems-Application and Design, TMH, 2007.

REFERENCE BOOK(S):

1. Joseph J.Carr, Elements of Electronics Instrumentation and Measurement, Pearson Education, 2003.
2. Alan. S. Morris, Principles of Measurements and Instrumentation, 2ndEdition, Prentice Hall of India, 2003.
3. David A. Bell, Electronic Instrumentation and measurements, Prentice Hall of India Pvt Ltd, 2003.
4. B.C. Nakra and K.K. Choudhry, Instrumentation, Meaurement and Analysis, 2ndEdition, TMH, 2004.
5. James W. Dally, William F. Riley, Kenneth G. McConnell, Instrumentation for Engineering Measurements, 2ndEdition, John Wiley, 2003

COURSE OUTCOME(S):

CO603-2. 1 Learn the basic measurement concepts.

CO603-2. 2 Learn the concepts of electronic measurements.

CO603-2. 3 Learn the importance of signal generators and signal analysers in measurements.

CO603-2. 4 Learn the relevance of digital instruments in measurements.

CO603-2. 5 Learn the need for data acquisition systems and the measurement techniques in optical domains.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	2	1	2	1	1	1					1	2

CO202	1	2	1	1	1	3					1	1
CO203	1	1	2	1	1	1					1	1
CO204	2	1	1	1	1	1					1	2
CO205	1	2	1	1	1	1					1	1

1→Low 2→Medium 3→High

19EC6703 ADVANCED MICROPROCESSORS AND MICROCONTROLLERS L T P C
3 0 0 3

OBJECTIVES:

- To expose the students to the fundamentals of microprocessor architecture.
- To introduce the advanced features in microprocessors and microcontrollers.
- To enable the students to understand various microcontroller architectures

PRE-REQUISITE:

Microprocessor and Microcontroller Programming and Interfacing

UNIT I HIGH PERFORMANCE CISC ARCHITECTURE–PENTIUM 9

CPU Architecture-Bus Operations –Pipelining –Brach predication –floating point unit-Operating Modes –Paging –Multitasking –Exception and Interrupts –Instruction set –addressing modes –Programming the Pentium processor.

UNIT II HIGH PERFORMANCE RISC ARCHITECTURE–ARM 9

Arcon RISC Machine –Architectural Inheritance –Core & Architectures -Registers –Pipeline -Interrupts –ARM organization -ARM processor family –Co-processors-ARM instruction set-Thumb Instruction set -Instruction cycle timings -The ARM Programmer‟s model –ARM Development tools –ARM Assembly Language Programming -C programming –Optimizing ARM Assembly Code –Optimized Primitives.

UNIT III ARM APPLICATION DEVELOPMENT 9

Introduction to DSP on ARM –FIR filter –IIR filter –Discrete fourier transform –Exception handling –Interrupts –Interrupt handling schemes-Firmware and boot loader –Embedded Operating systems –Integrated Development Environment-STDIO Libraries –Peripheral Interface –Application of ARM Processor -Caches –Memory protection Units –Memory Management units –Future ARM Technologies.

UNIT IV MOTOROLA 68HC11 MICROCONTROLLERS 9

Instruction set addressing modes –operating modes-Interrupt system-RTC-Serial Communication Interface –A/D Converter PWM and UART.

UNIT V PIC MICROCONTROLLER 9

CPU Architecture –Instruction set –interrupts-Timers-I2C Interfacing –UART-A/D Converter –PWM and introduction to C-Compilers.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Andrew N.Sloss, Dominic Symes and Chris Wright “ARM System Developer‟s Guide: Designing and Optimizing System Software”, First edition, Morgan Kaufmann Publishers, 2004.

REFERENCE BOOK(S):

1. Steve Furber, "ARM System –On –Chip architecture", Addision Wesley, 2000.
2. Daniel Tabak , "Advanced Microprocessors",McGraw Hill.Inc., 1995
3. James L. Antonakos, "The Pentium Microprocessor",Pearson Education, 1997.
4. Gene .H.Miller, "Micro Computer Engineering",Pearson Education , 2003.

COURSE OUTCOME(S):

CO603-3. 1 Work with CISC architecture- Pentium for a specific real world application.

CO603-3. 2 Work with RISC architecture- ARM for a specific real world application.

CO603-3. 3 Work with ARM Application Development.

CO603-3. 4 Work with Motorola 68HC11Microcontroller for a specific real world application.

CO603-3. 5 Work with PIC Microcontroller for a specific real world application.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	3	3	2	1	1							1
CO302	3	3	2	1	1							1
CO303	3	3	2	1	1							1
CO304	3	3	2	1	1							1
CO305	3	3	2	1	1							1

1→Low 2→Medium 3→High

19EC6704 DEEP LEARNING L T P C
3 0 0 3

OBJECTIVES:

- To present the mathematical, statistical and computational challenges of building stable representations for high-dimensional data, such as images, text and data.
- To learn the fundamentals of deep learning, and the main research activities in this field.
- To learn to implement, train, and validate neural network.

PRE-REQUISITE:

- Python Programming

UNIT I INTRODUCTION 9

Content: Basics of Deep learning, Trends in deep learning, Applied Math and Machine Learning Basics, Linear Algebra, Probability and Information Theory, Numerical Computation, Deep learning vs Machine learning

UNIT II MODERN DEEP NETWORKS 9

Modern Deep Networks, Deep Feed forward Networks, Regularization for Deep Learning, Optimization for Training Deep Models, The Convolutional Operation, Pooling, Convolution and pooling as an Infinitely string Prior, Structured output, Data types, Random and unsupervised features.

UNIT III SEQUENCE MODELLING 9

Unfolding unconditional blocks, Recurrent Neural network, Bidirectional RNNs, Encoder Decoder Sequence to sequence architecture, Recursive neural network, Recursive neural network and Long Short-Term Memory Network (LSTM).

UNIT IV DEEP NEURAL NETWORKS 9

Tuning/Debugging Neural Networks-Parameter search, Over fitting, Visualizations, Practical Aspects of deep learning, Batch Normalization and Programming Frameworks.

UNIT V DEEP REINFORCEMENT AND DEEP UNSUPERVISED LEARNING 9

Deep Reinforcement Learning, Deep Unsupervised Learning –Auto-encoders, Variation Auto-encoders, Adversarial Generative Networks.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation. (2015).
2. Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1 (2009): 1127.

REFERENCE BOOK(S):

1. Sutskever, Ilya, OriolVinyals, and Quoc V. Le. "Sequence to sequence learning with neural networks." Advances in neural information processing systems. 2014.
2. Kalchbrenner, Nal, Edward Grefenstette, and Phil Blunsom. "A convolutional neural network for modelling sentences." ACL (2014).

WEB RESOURCE(S):

1. https://www.coursera.org/specializations/deep-learning
2. https://www.edx.org/learn/deep-learning
3. https://www.udemy.com/topic/deep-learning/

COURSE OUTCOME(S):

CO603-4. 1 Illustrate the fundamentals of deep learning.
CO603-4. 2 Design deep neural network and Convolutional neural network for classification.
CO603-4. 3 Examine the sequence modelling using different algorithms.
CO603-4. 4 Analyze the improvement in deep neural network.
CO603-4. 5 Interpret for Deep Reinforcement Learning and Deep Unsupervised Learning.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO401	3	3	2	1	2						1	1
CO402	3	3	2	2	2						1	1
CO403	3	3	2	2	2						1	1
CO404	3	3	2	2	2						1	1
CO405	3	3	2	2	2						1	1

1→Low 2→Medium 3→High

19EC6705 NETWORK CRYPTOGRAPHIC TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

PRE-REQUISITE:

- Communication Networks

UNIT I INTRODUCTION 9

Computer Security Concepts-– OSI security architecture-Security Services – Security Mechanisms-Model for Network Security- Classical encryption techniques: substitution techniques, transposition techniques, steganography- product cryptosystem – cryptanalysis.

UNIT II SYMMETRIC KEY CRYPTOGRAPHY 9

Mathematics Of Symmetric Key Cryptography: Algebraic structures – Modular arithmetic-Euclid‟s algorithm- Congruence and matrices -Groups, Rings, Fields- Finite fields- Symmetric Key Ciphers: - Principles of DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard

UNIT III PUBLIC KEY CRYPTOGRAPHY 9

Mathematics Of Asymmetric Key Cryptography: Primes – Primality Testing –Factorization – Euler‟s totient function, Fermat‟s and Euler‟s Theorem – Chinese Remainder Theorem – Exponentiation and logarithm – Asymmetric Key Ciphers: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - Elliptic curve arithmetic- Elliptic curve cryptography.

UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications – Kerberos, X.509

UNIT V NETWORK AND SYSTEM SECURITY 9

Electronic Mail security – PGP, S/MIME , – Transport level Security – secure sockets layer, transport layer security ,Wireless network security – IEEE 802.11 WLAN security – IP Security – System Security:- Intruders, Malicious software ,viruses , Firewalls.

TOTAL HOURS: 45

TEXT BOOK(S):

1. William Stallings, “Cryptography and Network Security - Principles and Practices”, Pearson Education, 6th edition, New Delhi.2017

REFERENCE BOOK(S):

1. Behrouz A Forouzan and Debdeep Mukhopadhyay, “Cryptography and Network Security”, Tata McGraw Hill, New Delhi, 2011.

2. Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill, New Delhi, 2013
3. Douglas R Stinson, "Cryptography - Theory and Practice", Chapman and Hall / CRC Press, New York, 2013.

COURSE OUTCOME(S):

CO603-5. 1 Understand the fundamentals of networks security, security architecture, threats and vulnerabilities.

CO603-5. 2 Apply the different cryptographic operations of symmetric cryptographic algorithms.

CO603-5. 3 Apply the different cryptographic operations of public key cryptography.

CO603-5. 4 Apply the various Authentication schemes to simulate different applications.

CO603-5. 5 Understand various Security practices and System security standards.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO501	2		2	1								1
CO502	2	1	2	1							2	1
CO503	2	1	2	2							2	2
CO504	2	1	2	2								2
CO505	2	1	2	2								1

1→Low 2→Medium 3→High

19EC6706 DSP ARCHITECTURE L T P C
3 0 0 3

OBJECTIVES:

- Digital Signal Processor basics
- Third generation DSP Architecture and programming skills
- Advanced DSP architectures and some applications.

PRE-REQUISITE:

- Discrete Time Signal Processing

UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs 9

Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access in PDSPs –Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals.

UNIT II TMS320C5X PROCESSOR 9

Architecture – Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure, Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals.

UNIT III TMS320C6X PROCESSOR 9

Architecture of the C6x Processor - Instruction Set - DSP Development System: Introduction – DSP

Starter Kit Support Tools- Code Composer Studio - Support Files – Programming Examples to Test the DSK Tools – Application Programs for processing real time signals.

UNIT IV ADSP PROCESSORS 9

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

UNIT V ADVANCED PROCESSORS 9

Architecture of TMS320C54X: Pipe line operation, Code Composer studio – Architecture of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx, cengage Learning India Private Limited, Delhi 2012
2. B.Venkataramani and M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications" – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.

REFERENCE BOOK(S):

1. Rulph Chassaing, Digital Signal Processing and Applications with the C6713 and C6416 DSK, A JOHN WILEY & SONS, INC., PUBLICATION, 2005
2. User guides Texas Instrumentation, Analog Devices, and Motorola.

COURSE OUTCOME(S):

CO604-1. 1 To understand the fundamentals of DSP processors.

CO604-1. 2 Understand the working of TMS320C5X PROCESSOR.

CO604-1. 3 Understand the working of TMS320C6X PROCESSOR.

CO604-1. 4 Understand the working of ADSP processors.

CO604-1. 5 Work with Commercial DSP processors and their Development Tools.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	2	1						2	2	1		
CO102	2	1						1	1	2		
CO103	3	2	1					2	2	2		3
CO104	2	1						1	1	1		2
CO105	3	2	2					2	2	2		2

1→Low 2→Medium 3→High

19EC6707 AD HOC AND WIRELESS SENSOR NETWORKS L T P C

3 0 0 3

OBJECTIVES:

- Learn Ad hoc network and Sensor Network fundamentals.

- Understand the different routing protocols.
- Have an in-depth knowledge on sensor network architecture and design issues.
- Understand the transport layer and security issues possible in Ad hoc and Sensor networks.
- Have an exposure to mote programming platforms and tools.

PRE-REQUISITE:

- Communication Networks.

UNIT I AD HOC NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS 9

Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols - Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).

UNIT II SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES 9

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

UNIT III WSN NETWORKING CONCEPTS AND PROTOCOLS 9

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Contention based protocols - PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols- Energy Efficient Routing, Challenges and Issues in Transport layer protocol.

UNIT IV SENSOR NETWORK SECURITY 9

Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS 9

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.

TOTAL HOURS: 45

TEXT BOOK(S):

1. C. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks Architectures and Protocols”, Prentice Hall, PTR, 2006.
2. Holger Karl, Andreas willig, “Protocol and Architecture for Wireless Sensor Networks”, John wiley publication, Jan 2006.

REFERENCE BOOK(S):

1. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks: an information processing approach", Elsevier publication, 2004.
2. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000.
3. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, "Wireless sensor networks: a survey", computer networks, Elsevier, 2002, 394 - 422.

COURSE OUTCOME(S):

CO604-2. 1 Know the basics of Ad hoc networks and Routing protocols.

CO604-2. 2 Be familiar with the transceiver system for Sensor networks.

CO604-2. 3 Apply the knowledge to identify WSN concepts and protocols.

CO604-2. 4 Understand the transport layer and security issues possible in Ad hoc and sensor networks.

CO604-2. 5 Know the simulation tools for Sensor network platforms.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	2	1	2					1		1	3
CO202	3	2	1	2					2		1	3
CO203	3	2	2	2					2		1	3
CO204	3	2	1	1					2		1	3
CO205	3	2	1	2					2		1	3

1→Low 2→Medium 3→High

19EC6708 ELECTRONIC TESTING AND PACKAGING L T P C
3 0 0 3

OBJECTIVES:

- To understand the basics of testing and the testing equipments.
- To understand the analog testing.
- To understand the digital testing.
- To give a comprehensive introduction to the various packaging types used along with the associated same the thermal, speed, signal and integrity power issues.
- To learn all the different packaging styles of semiconductors.

PRE-REQUISITE:

- Analog Electronics.

UNIT I INTRODUCTION 9

Test process and automatic test equipment, test economics and product quality, fault modeling

UNIT II DIGITAL TESTING 9

Logic and fault simulation, testability measures, combinational and sequential circuit test generation.

UNIT III ANALOG TESTING 9

Memory Test, DSP Based Analog and Mixed Signal Test, Model based analog and mixed signal test, delay test, IIDQ test.

UNIT IV OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING 9

Definition of a system and history of semiconductors, Products and levels of packaging, Packaging aspects of handheld products, Definition of PWB, Basics of Semiconductor and Process flowchart, Wafer fabrication, inspection and testing, Wafer packaging; Packaging evolution; Chip connection choices, Wire bonding, TAB and flip chip.

UNIT V SEMICONDUCTOR PACKAGES 9

Single chip packages or modules (SCM), Commonly used packages and advanced packages; Materials in packages; Thermal mismatch in packages; Multichip modules (MCM)-types; System-in-package (SIP); Packaging roadmaps; Hybrid circuits; Electrical Design considerations in systems packaging, Resistive, Capacitive and Inductive Parasitics, Layout guidelines and the Reflection problem, Interconnection.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Michael L. Bushnell and Vishwani D. Agarwal, "Essentials of Electronic Testing for Digital, Memory & Mixed-Signal VLSI Circuits", Springer, 2006.
2. Rao R. Tummala, "Fundamentals of Microsystems Packaging", McGraw Hill, NY, 2001

REFERENCE BOOK(S):

1. Dimitris Gizopouilos, "Advances in Electronic Testing", Springer 2006.

COURSE OUTCOME(S):

CO604-3. 1 Explain different testing equipment's.

CO604-3. 2 Design the different testing schemes for analog circuit.

CO604-3. 3 Design the different testing schemes for digital circuit.

CO604-3. 4 Understand and gain knowledge about semiconductor and basic of wafer fabrication.

CO604-3. 5 Learn all the different packaging styles of semiconductors.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	3											2
CO302	3	3	3									2
CO303	3	3	3									2
CO304	3											2
CO305	3					2	2					

1→Low 2→Medium 3→High

19EC6709 SENSORS AND TRANSDUCERS

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To understand the concepts of measurement technology.
2. To learn the various ranging sensors used to measure various physical parameters.
3. To learn the various heading sensors used to measure various physical parameters.
4. To learn the various temperature sensors used to measure various physical parameters.
5. To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

PRE-REQUISITE:

- Analog Electronics

UNIT I INTRODUCTION 9

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

UNIT II MOTION, PROXIMITY AND RANGING SENSORS 9

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive,LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT III FORCE, MAGNETIC AND HEADING SENSORS 9

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS 9

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT V SIGNAL CONDITIONING and DAQ SYSTEMS 9

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multichannel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Ernest O Doebelin, “Measurement Systems – Applications and Design”, Tata McGraw-Hill, 2009.
2. Sawney A K and Puneet Sawney, “A Course in Mechanical Measurements and Instrumentation and Control”, 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

REFERENCE BOOK(S):

1. Patranabis D, “Sensors and Transducers”, 2nd Edition, PHI, New Delhi, 2010.

2. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 1999.
3. Richard Zurawski, "Industrial Communication Technology Handbook" 2nd edition, CRC Press, 2015.

COURSE OUTCOME(S):

CO604-4. 1 Expertise in various calibration techniques and signal types for sensors.

CO604-4. 2 Apply the various sensors in the Automotive and Mechatronics applications.

CO604-4. 3 Study the basic principles of various smart sensors.

CO604-4. 4 Implement the DAQ systems with different sensors for real time applications.

CO604-4. 5 Study the Concept of Signal Conditioning.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO401	2	1	1	2					1		1	3
CO402	2	3	2	2					1		1	3
CO403	3	2	1	2					1		1	3
CO404	2	2	1	2					1		1	3
CO405	3	1	1	2					1		1	3

1→Low 2→Medium 3→High

19EC6710 SATELLITE COMMUNICATION L T P C
3 0 0 3

OBJECTIVES:

- Understand the basics of satellite orbits
- Understand the satellite segment and earth segment
- Analyze the various methods of satellite access
- Understand the applications of satellites
- Understand the basics of satellite Networks

PRE-REQUISITE:

- Analog and Digital Communication.

UNIT I SATELLITE ORBITS 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.

UNIT II SPACE SEGMENT 9

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

UNIT III SATELLITE LINK DESIGN 9

Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.

UNIT IV SATELLITE ACCESS AND CODING METHODS 9

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

UNIT V SATELLITE APPLICATIONS 9

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH).

TOTAL HOURS: 45

TEXT BOOK(S):

1. Dennis Roddy, "Satellite Communication", 4th Edition, Mc Graw Hill International, 2017.
2. Timothy,Pratt,Charles,W.Bostain,JeremyE.Allnutt,"SatelliteCommunication",2nd Edition, Wiley Publications,2002

REFERENCE BOOK(S):

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.
2. M.Richharia, "Satellite Communication Systems-Design Principles", Macmillan 2003.

COURSE OUTCOME(S):

CO604-5. 1 Analyze the satellite orbits.

CO604-5. 2 Analyze the earth segment and space segment.

CO604-5. 3 Analyze the satellite Link design.

CO604-5. 4 Design various satellite applications.

CO604-5. 5 Study different applications of satellite systems.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO501	1	2			3							
CO502	1	3	2						1	2		1
CO503		2	3	3								2
CO504		2			3					3		
CO505		1		2					3	2		

1→Low 2→Medium 3→High

19EC6711 EMBEDDED SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand embedded systems and its importance.
- To gain knowledge in Embedded Processors architecture and Programming.
- To develop Wireless and RTOS applications using ARM
- Learn the fundamentals of operating system
- Know the concept of implementing various wireless communication techniques

PRE-REQUISITE:

- Microprocessors and Microcontrollers.

UNIT I COMPONENTS OF EMBEDDED SYSTEM 9

Embedded Systems – Characteristics - Challenges in Embedded Computing system design – Embedded System Design Process - Design example: Model train controller- Design methodologies- Design flows- Designing Hardware and Software Components - System Integration.

UNIT II ARM PROCESSOR 9

CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture - ARM Architecture (Cortex M4) – Design Philosophy – ARM processor families – ARM Instruction Set – Thumb Instruction Set – ARM Programming – Exception and Interrupt handling

UNIT III TIVA LAUNCHPAD BASED EMBEDDED SYSTEMS 9

TIVA Launch pad Architecture – Design and Development Process, GPIO interfacing, Serial Interface, I/O Synchronization, ADC and Data acquisition, Interrupts.

UNIT IV MULTIPROCESSORS AND OPERATING SYSTEMS 9

Multiprocessors- CPUs and accelerators - Multiprocessors performance analysis - Multiple tasks and multiple processes - Pre-emptive real time operating systems - Priority based scheduling – Inter process communication mechanisms - Evaluating operating system performance - Power management and optimization for processes.

UNIT V WIRELESS AND INTERNET OF THINGS 9

Introduction to Internet of Things - Design issues – Design methodologies -Wireless communication modules for Embedded Systems – RF, Bluetooth, Zigbee, Wifi.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Wayne Wolf, “Computers as Components - Principles of Embedded Computer System Design”, 2nd Edition, Morgan Kaufmann Publisher, 2008.
2. Andrew Sloss, Dominic Symes, and Chris Wright, "ARM System Developer's Guide Designing and Optimizing System", Elsevier India Private Limited, 2009.

REFERENCE BOOK(S):

1. Agus Kurniawan, “TI ARM Cortex-M Launch Pad Programming by Example”, PE Press – Computers, 2014

2. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dreamtech press, 2005.
3. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.

WEB RESOURCE(S):

- https://nptel.ac.in/courses/108/102/108102045/
- https://nptel.ac.in/courses/106/105/106105193/
- https://nptel.ac.in/courses/117/106/117106112/
- https://nptel.ac.in/courses/108/108/108108098/

COURSE OUTCOME(S):

CO605-1. 1 Analyse the functions of the components in Embedded Systems
CO605-1. 2 Design the hardware and software components in embedded field
CO605-1. 3 Apply TIVA based processors in Embedded System Design
CO605-1. 4 Design scheduling algorithms in multiprocessors and operating systems
CO605-1. 5 Develop Wireless and RTOS based Embedded Systems

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	3	3	3	3	2							3
CO102	3	3	3	3	2	1						3
CO103	3	3	3	3	2	1						3
CO104	3	3	3	3	2	1						3
CO105	3	3	3	3	2	1						3

1→Low 2→Medium 3→High

19EC6712 FIBRE OPTIC NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- The students Optical system components like optical amplifiers, wavelength converters.
- The students can able to understand IP protocols.
- The students can able to understand SONET and SDH Netwoks
- The students can able to understand Network design perspectives.
- To impart knowledge on various communication channel modelling.

PRE-REQUISITE:

- Communication Networks

UNIT I INTRODUCTION TO OPTICAL NETWORKS 9

Telecommunications Networks Architecture, Services, circuit switching and packet switching, Optical Networks: Multiplexing Techniques, Second generation Optical Networks, Optical Packet Switching, Transmission Basics: Wavelength, frequencies, and channel spacing, Wavelength standards, Optical power and loss, Network Evolution, Nonlinear Effects: Self-phase Modulation, Cross-phase Modulation, Four Wave mixing, Solitons. Components: Couplers, Isolators and Circulators, Multiplexers and Filters, Optical Amplifiers, Transmitters, Detectors, Switches, Wavelength Converters.

UNIT II TRANSMISSION SYSTEM ENGINEERING 9

System Model, Power Penalty, Transmitter, Receiver, Optical Amplifiers, Crosstalk, Dispersion, Wavelength Stabilization, Overall Design Considerations. Optical Internets: Migration to IP optical networking, IP and Optical backbone, IP Routing table, MPLS and optical cross connect table, Protocol stack Alternatives, Internetworking SS7 and Legacy Transport, Internet transport network protocol stack.

UNIT III SONET, SDH AND OPTICAL TRANSPORT NETWORKS (OTNS) 9

SONET and SDH: SONET multiplexing hierarchy, Frame structure, Functional Component, problem detection, concatenation. Architecture of Optical Transport Networks (OTNs): Digital wrapper, in-band and out-of band control signalling, Importance of Multiplexing and multiplexing hierarchies, SONET multiplexing hierarchies, SDH multiplexing hierarchies, New Optical Transport, OTN layered Model, Generic Framing Procedure (GFP)

UNIT IV WDM, NETWORK TOPOLOGIES, MPLS AND OPTICAL NETWORKS 9

WDM: WDM operation, Dense Wavelength Division Multiplexing (DWDM), Erbium-doped Fiber (EDF), WDM amplifiers, Add-Drop Multiplexers, Wavelength Continuity Property, Higher dispersion for DWDM, Tunable DWDM Lasers.

UNIT V FREE SPACE CHANNEL MODELLING 9

Indoor optical wireless communication channel – LOS & NLOS propagation model – Ceiling Bounce model – Hayasaka-Ito model spherical model – Artificial light interference – Incandescent lamp - fluorescent driven by conventional ballast & Fluorescent Model - lamp Outdoor Channel – Atmospheric channel loss – Fog and visibility – beam divergence – optical and window loss – Pointing loss – Atmospheric turbulence models.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Rajiv Ramaswami and Kumar Sivarajan, Optical Networks: A practical perspective, Morgan Kaufmann, 3rd edition, 2009.
2. Vivek Alwayn, Optical Network Design and Implementation, Pearson Education, 2004.
3. Hussein T.Mouftab and Pin-Han Ho, Optical Networks: Architecture and Survivability, Kluwer Academic Publishers, 2002.
4. Biswanath Mukherjee, Optical Communication Networks, McGraw Hill, 1997.
5. Z. Ghassemlooy, W. Popoola, S. Rajbhandari, "Optical Wireless Communications: System and Channel Modelling with MATLAB®", CRC Press, 2013.

WEB RESOURCE(S):

- https://nptel.ac.in/courses/117/101/117101050/
- http://home.iitk.ac.in/~ynsingh/seminars/OptNets.pdf
- http://www.iitg.ac.in/psm/qip2015/material/Subir_Bandyopadhyay_Lecture1.pdf
- http://www.svnit.ac.in/web/department/electronics/EC608.php

COURSE OUTCOME(S):

CO605-2. 1 Assess and Evaluate optical networks

CO605-2. 2 Understand the transmission system model and optical networks.

CO605-2. 3 Describe briefly about SONET and SDH.

CO605-2. 4 Understand the operation of WDM network.

CO605-2. 5 Discuss various communication channel modelling.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	3	3	2	2	1	1				2	3
CO202	3	3	3	2	2	1	2				2	2
CO203	3	3	3	2	1	2	2	1	1	1	1	2
CO204	3	3	3	2	2	2	2				3	1
CO205	3	3	3	1	1	2	2				1	3

1→Low 2→Medium 3→High

19EC6713 4G & 5G NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- To understand the shortcomings of 4G technology and exploring the architecture of 5G
- To understand the 5G Modulation Schemes
- To understand different types of multiple access techniques in 5G
- To explore power optimization algorithms for user end data transmission
- To understand and analyze the concept of MIMO and other research areas in 5G

PRE-REQUISITE:

- Ad hoc and Wireless Sensor Networks, Wireless Networks

UNIT I EVOLUTION OF 4G AND 5G NETWORKS 9

OFDM principle- Modulation, Cyclic Prefix, Challenges in 4G- Windowing, PAPR, Introduction to 5G, vision and challenges, 5G NR – New Radio – air interface of 5G, radio access, Ultra-Dense Network Architecture and Technologies for 5G- Concept and Challenges of UDN, Key Technologies of UDN-Flexible Networking, Multi-RATs Coordination

UNIT II 5G MODULATION SCHEMES 9

Introduction to Equalization- types - Filter-bank based multi-carrier (FBMC), Universal filtered multi carrier (UFMC), Generalized frequency division multicarrier (GFDM) - Principles, Transceiver Block diagram, Frame structure, Resource structure, allocation, mapping, MIMO-GFDM

UNIT III MULTIPLE ACCESS TECHNIQUES IN 5G 9

NOMA – Principle- Superposition Coding, Successive Interference Cancellation, Power Domain NOMA, Sparse Code NOMA- types, Power Domain Sparse Code NOMA and IDMA **Relaying:** The role of relaying and network coding in 5G wireless networks -Multi-flow wireless backhauling-Highly flexible multi-flow relaying-Buffer-aided relaying

UNIT IV POWER OPTIMIZATION ALGORITHMS **9**

Introduction to Power Optimization- One Dimensional-Multi dimensional, Multi- Objective Optimization- Geometric – Cone Programming - Convex Optimization- Ant Colony- Genetic Algorithms- Fuzzy Logic- Heuristic Algorithms.

UNIT V MIMO AND OTHER 5G RESEARCH TOPICS **9**

Introduction, MIMO in LTE, Theoretical background, Single user MIMO, Multi-user MIMO, Capacity of massive MIMO: a summary, Basic forms of massive MIMO implementation, Hybrid beam forming for interference clustering and user grouping, Channel models, Machine type communications, D2D communications..

TOTAL: 45 PERIODS

TEXTBOOKS

1. Afif Osseiran, Jose.F.Monserrat and Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016.
2. Xiang, W; Zheng, K; Shen, X.S; "5G Mobile Communications", Springer, 2016

REFERENCES:

1. Saad Z Asif, "5G Mobile Communication,Concepts and Challenges", CRC Press
2. Thomas L. Marzetta, Erik G. Larsson, Hong Yang , Hien Quoc Ngo, "Fundamentals of Massive MIMO", Cambridge University Press, 2018.
3. Erik Dahlman Stefan Parkvall Johan Skold, "5G NR: The Next Generation Wireless Access Technology" - 1st Edition, Associated press, 2018

WEB RESOURCE(S):

- https://nptel.ac.in/courses/117/104/117104099/
- https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ee16/
- https://nptel.ac.in/courses/108/106/108106137/
- https://swayam.gov.in/nd1_noc20_ee36/preview

COURSE OUTCOME(S):

CO605-3. 1 Ability to comprehend the 4G technology and appreciate the significance of 5G technology and its architecture.

CO605-3. 2 Ability to characterizing the different 5G modulation schemes.

CO605-3. 3 The student would be capable of understanding the different 5G multiple access Schemes

CO605-3. 4 To identify suitable power allocation and optimization techniques for the wireless systems

CO605-3. 5 The student would be capable of exploiting multiple antenna techniques for capacity/ performance gains and explore other research areas in 5G.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	3	3										
CO302	3	3		2	2	2	2	2	2	2		2
CO303	3	3	2					2	2	1		2

CO304	3	3	3			1	1	1	1	1		1
CO305	3	3		2	1	1	1					

1→Low 2→Medium 3→High

19EC6714 OFDM SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the concepts of OFDM and channel models
- To have a knowledge of the basics of OFDM and Synchronization error
- To study the signal processing and channel estimation aspects of OFDM
- To understand the interleaving and coding techniques in OFDM
- To understand the peak power problem and the methods of reducing it.

PRE-REQUISITE:

- Wireless Networks

UNIT I BASEBAND DATA TRANSMISSION 9

Baseband Communication - Baseband PAM –One Shot Minimum Distance Receiver –Minimum Distance Sequence Detection —M-ary signalling scheme-shaping of the transmitted signal spectrum-Noise in Baseband System - Coherent and Non coherent Technique, Orthogonal Modulation – OFDM modulation and Demodulation –Multidimensional Modulation-Modulation with Memory.

UNIT II BAND-LIMITED CHANNELS 9

Channel - Pulse shape design for channels with ISI: Nyquist pulse, Partial response signaling (duobinary and modified duobinary pulses), demodulation; Channel Models: Fading Dispersive channel, Time and Frequency Selective, Rayleigh channel, karhunen- Loeve Expansion; Diversity Technique: Space, polarization, path, angle, Time and frequency, Diversity Combining Technique

UNIT III EQUALIZATION 9

Optimal Zero-Forcing Equalization- Generalized Equalization Methods- Fractionally Spaced Equalizer – Transversal Filter Equalizer –ISI and Channel Capacity –Constrained –complexity Equalizers – Adaptive Linear Equalizer – Adaptive DFE.

UNIT IV DETECTION 9

Detection of a Single Real-Valued Symbol- Detection of a Signal Vector –Known Signals in Gausian Noise –ML Sequence Detection with the Viterbi Algorithm – A Posteriori Probability Detection with BCJR- Symbol Error Probability for MLSD – incoherent Detection –Shot Noise Signal with known Intensity. Hypothesis Testing and the MAP Criterion, Bayes Criterion, Minimax Criterion, Neyman-Pearson Criterion, Sequential Detection.

UNIT V FUNDAMENTALS OF ESTIMATION THEORY 9

Formulation of the General Parameter Estimation Problem, Relationship between Detection and Estimation Theory, Types of Estimation Problems, Properties of Estimators, Bayes Estimation, Minmax Estimation, Maximum-Likelihood Estimation, Comparison of Estimator Parameters.

TOTAL HOURS: 45

TEXT BOOK(S):

1. J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems", Pearson Education 2014.
2. Rappaport,T.S., "Wireless communications", Pearson Education, Second Edition, 2010.

REFERENCE BOOK(S):

1. John R Barry, Edward Lee and David G. Messerschmitt, Digital Communication, Springer, 2008.
2. John G. Proakis, Digital Communications, McGraw –Hill International Edition, 2009.
3. Simon Haykin, Communication Systems, PHI, 2008.
4. BemardSklar, Digital Communications: Fundamentals and Applications, Prentice Hall, 2001.
5. Bikash Kumar Dey, Digital Communication, NPTEL courseware 2008
6. M. K. Simon, S. M. Hinedi and W. C. Lindsey, Digital Communication Techniques: Signaling and detection, Prentice Hall India, N. Delhi, 1995.
7. Bernard C. Levy, Principles of Signal Detection and Parameter Estimation, Springer, 2008.

WEB RESOURCE(S):

- http://publichealthinsurance.xyz/10booker/nnd5bgaaqbaj/
- https://www.abebooks.com/9780792375487/Digital-Communication-Barry-John-Lee-0792375483/plp

COURSE OUTCOME(S):

CO605-4. 1 Understanding of application of OFDM for communication systems.

CO605-4. 2 Knowledge of various techniques and aspects of OFDM.

CO605-4. 3 Discussion about design and simulation of modulation and coding techniques using software.

CO605-4. 4 Learn the problems in OFDM and Hybrid OFDM.

CO605-4. 5 Learn the problems in Hybrid OFDM.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO401	3		3		3			2			3	3
CO402	3		3		3			2			3	3
CO403	3		3		3			2			3	3
CO404	3		3		3			2			3	3
CO405	3		3		3			2			3	3

1→Low 2→Medium 3→High

19EC6715 RADAR AND NAVIGATIONAL AIDS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the student to understand the basic principles of radar operation and the different types of radars an applications.
- To enable the student to understand the different systems involved in radar configuration, the signal processing aspects to accurately detect and interpret signals and the antenna systems for signal capture.

- To enable the student to understand the role of radar systems
- To enable the student to understand role of navigational and landing aid**.**
- To enable the student to understand positioning, navigation, and timing (PNT) services

PRE-REQUISITE:

- Satellite Communication

UNIT I RANGE EQUATION AND RADAR 9

Basic Radar, Radar equation, Radar parameters, Block diagram, Radar frequencies. Types of Radar: CW, Doppler, MTI, FMCW, Pulsed, Tracking Radar. DSP in Radar (MTD1).

UNIT II RADAR SYSTEMS 9

Different type of Noise, Noise figure, LNA. False alarm & Missed detection, Radar cross section, TR, ATR, Types of Displays - Colour CRT, Bright displays, synthetic video displays, A scope, PPI**.**

UNIT III SIGNAL PROCESSING 9

Detection of radar signals in Noise and clutter, detection of non-fluctuating target in noise, Matched filter, Matched filter response to delayed Doppler shifted signals, Radar measurements. Doppler Processing, Linear FM Pulse Compression, Passive System: Digital compression, SAW pulse compression. Signal processing in Antenna arrays**.**

UNIT IV RADIO NAVIGATION 9

General principles, Radio compass (NDB), ADF, VOR, DME., Hyperbolic Navigation DECCA,OMEGA, LORAN, Mechanics of Landing: Instrument Landing System, Microwave Landing System.

UNIT V SATELLITE NAVIGATION AND HYBRID NAVIGATION SYSTEMS 9

Basics of Satellite Navigation, Introduction to Global Positioning System., System Description, Basic principles, position, velocity determination, Signal structure- DGPS, Integration of GPS & INS.

TOTAL HOURS: 45

TEXT BOOK(S):

1. M.I.Skolnik, ―Introduction to Radar Systems‖, Tata McGraw Hill 2017.
2. Myron Kyton and W.R.Fried ―Avionics Navigation Systems‖ John Wiley & Sons 1997.
3. Nagaraja ―Elements of Electronic Navigation‖ Tata McGraw Hill, 2nd ed, 2000.
4. Albert Helfrick. D, _Principles of Avionics', Avionics communications Inc., 2004
5. Nathansan, ―Radar design principles-Signal processing and environment‖, 2/e, PHI, 2007.
6. Hofmann-Wellenhof, Hlichlinegger and J.Collins, ―GPS Theory and Practice‖, 5/e SpringerInternational Edition, 2007.
7. Roger J.Sullivan, ―Radar foundations for Imaging and advanced concepts‖, PHI,2004.

WEB RESOURCE(S):

- http://lilograri.gotdns.ch/forum/?q=introduction+to+radar+systems+skolnik+mcgraw+hill+2nd+edition

COURSE OUTCOME(S):

CO605-5. 1 The student would demonstrate an understanding of the basic principles of radar design.

CO605-5. 2 The student would be able to identify suitable navigation systems and their usage for a given application scenario.

CO605-5. 3 The student would be familiar with the use of navigational systems for estimating and measuring the parameters and analyzing and interpreting them.

CO605-5. 4 The student would be familiar with the use of positioning, navigation, and timing (PNT) services

CO605-5. 5 The student would be able to know applications of Radar.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO501	3		3		3			2			3	3
CO502	3		3		3			2			3	3
CO503	3		3		3			2			3	3
CO504	3		3		3			2			3	3
CO504	3		3		3			2			3	3

1→Low 2→Medium 3→High

19EC7701 OPTO ELECTONIC DEVICES L T P C

3 0 0 3

OBJECTIVES:

- Learn the basics of solid state physics.
- Learn the basics of display devices and LASER.
- Study the chacteristics of optical detection devices.
- Learn the design of optoelectronic Modulator.
- Study the chacteristics of optoelectronic integrated circuits.

PRE-REQUISITE:

- Electronic Devices & Circuit Analysis

UNIT I ELEMENTS OF LIGHT AND SOLID STATE PHYSICS 9

Wave nature of light, Polarization, Interference, Diffraction, Light Source, review of Quantum Mechanical concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.

UNIT II DISPLAY DEVICES AND LASERS 9

Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of Lasers, Mode Locking, laser applications.

UNIT III OPTICAL DETECTION DEVICES **9**

Photo detector, Thermal detector, Photo Devices, Photo Conductors, Photo diodes, Detector Performance.

UNIT IV OPTOELECTRONIC MODULATOR **9**

Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acoustoptic devices, Optical, Switching and Logic Devices.

UNIT V OPTOELECTRONIC INTEGRATED CIRCUITS **9**

Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Pallab Bhattacharya "Semiconductor Opto Electronic Devices", Prentice Hall of India Pvt., Ltd.New Delhi, 2006.
2. Jasprit Singh, "Opto Electronics – As Introduction to Materials and Devices", Mc Graw-Hill International Edition, 1998

REFERENCE BOOK(S):

1. S C Gupta, Opto Electronic Devices and Systems, Prentice Hal of India, 2005.
2. J. Wilson and J.Haukes, "Opto Electronics – An Introduction", Prentice Hall, 1995

WEB RESOURCE(S):

1. https://www.accessengineeringlibrary.com
2. www.hindawi.com/journals
3. www.nanowerk.com

COURSE OUTCOME(S):

CO704-1. 1 Explain the basic elements of light and solid state physics.

CO704-1. 2 Describe the different types of luminescence, display devices and LASERS.

CO704-1. 3 Illustrate the characteristics of optical detection devices.

CO704-1. 4 Analyze the different kinds of opto electronic modulators.

CO704-1. 5 Analyze the different kinds of opto electronics Integrated Circuits.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	3	3		2	3	3					3	3
CO102	3	3	3	2	2	1					3	3
CO103	3	3	3	2	2	2					3	3
CO104	3	3	3	2	2	2	2				3	3
CO105	3	3	3	1	1	2	3				3	3

1→Low 2→Medium 3→High

19EC7702 CMOS ANALOG IC DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the fundamentals of MOS device modeling
- To understand the basics of analog IC design
- To gain knowledge on various configurations of MOS transistors and feedback concepts
- To study the characteristics of noise and frequency response of the amplifier
- To learn the concepts of Op-Amp frequency compensation

PRE-REQUISITE:

- Solid State Devices

UNIT I DEVICE MODELING **9**

General consideration of MOS devices – Equivalent circuit representation of MOS Transistor - Types of Compact Model - Basic modeling - Advanced MOSFET modeling - Second order effects - Prime importance of circuit and device simulations in VLSI

UNIT II ANALOG IC DESIGN AND CURRENT MIRRORS **9**

Concepts of Analog Design - nMOS and pMOS Transistor - Threshold voltage - Threshold voltage equations – I/V Characteristics - Basic current mirrors - Cascode current mirrors -Active current mirrors - Large and Small signal analysis - Common mode properties.

UNIT III AMPLIFIERS AND FEEDBACK **9**

Basic Concepts – Common source stage - Source follower - Common gate stage - Cascode stage. Single ended and differential operation - Basic Differential pair - Common mode response - Differential pair with MOS loads - Gilbert Cell. Feedback - General Consideration of feedback circuits - Feedback topologies - Effect of loading - Effect of feedback on Noise.

UNIT IV FREQUENCY RESPONSE OF AMPLIFIERS AND NOISE **9**

General considerations - Miller Effect and Association of Poles with Nodes, Common source Stage - Source followers - Common gate stage - Cascode stage - Differential pair. Noise - Statistical characteristics of noise - Types of noise - Representation of noise in circuits - Noise in single stage amplifiers - Noise in differential pairs - Noise Bandwidth.

UNIT V OPERATIONAL AMPLIFIER STABILITY AND FREQUENCY COMPENSATION **9**

General Considerations - One and Two Stage Op Amps - Gain Boosting – Comparison - Common mode feedback - Input range limitations - Slew rate - Power Supply Rejection - Noise in Op Amps - General consideration of stability and frequency compensation - Multipole system - Phase margin - Frequency compensation - Compensation of two stage op Amps - Other compensation techniques.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Behzad Razavi, ―Design of Analog CMOS Integrated Circuits, Tata McGraw Hill, 2001, 33rd re-print, 2016.

2. A.B.Bhattacharyya, " Compact MOSFET Models for VLSI Design", John Wiley & Sons Ltd., 2009

REFERENCES:

1. Trond Ytterdal, Yuhua Cheng and Tor A. Fjeldly Wayne Wolf, "Device Modeling for Analog and RF CMOS Circuit Design", John Wiley & Sons Ltd., 2001
2. Phillip Allen and Douglas Holmberg ―CMOS Analog Circuit Design‖ Second Edition, Oxford University Press, 2004.
3. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 5th Edition, Wiley, 2009
4. Grebene, ―Bipolar and MOS Analog Integrated circuit design‖, John Wiley & sons, Inc., 2003

WEB RESOURCE(S):

- https://nptel.ac.in/courses/117/101/117101105/
- vlsiacademy.org/cmos-analog-ic-design.html

COURSE OUTCOME(S):

CO704-2. 1 Understand the fundamentals of device modeling

CO704-2. 2 Realize the concepts of Analog MOS devices and current mirror circuits.

CO704-2. 3 Design different configuration of Amplifiers and feedback circuits.

CO704-2. 4 Analyze the characteristics of frequency response of the amplifier and its noise.

CO704-2. 5 Analyze the performance of the stability and frequency compensation techniques of Op-Amp Circuits.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	3	3	3	1							1
CO202	3	3	3	2	1	1						1
CO203	3	3	3	2	1	2						2
CO204	3	3	3	2	1	2	2					2
CO205	3	3	3	1	1	2	3		2		1	1

1→Low 2→Medium 3→High

19EC7703 DIGITAL IMAGE PROCESSING AND PATTERN RECOGNITION L T P C
3 0 0 3

OBJECTIVES:

- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Be familiar with segmentation techniques.
- Be familiar with image compression.
- Learn to represent image in form of features.

PRE-REQUISITE:

- Discrete Time Signal Processing

UNIT I DIGITAL IMAGE FUNDAMENTALS 8

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - color models.

UNIT II IMAGE ENHANCEMENT 10

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.

UNIT III IMAGE RESTORATION AND SEGMENTATION 9

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Morphological processing- erosion and dilation.

UNIT IV WAVELETS AND IMAGE COMPRESSION 9

Wavelets – Sub band coding - Multi resolution expansions - Compression: Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.

UNIT V IMAGE REPRESENTATION AND RECOGNITION 9

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TOTAL HOURS: 45

TEXT BOOK:

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Fourth Edition, Pearson Education, 2018.

REFERENCES:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
3. Willliam K Pratt, “Digital Image Processing”, John Willey, 2002.
4. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.

WEB RESOURCE(S):

1. http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html
2. http://eeweb.poly.edu/~onur/lectures/lectures.html

COURSE OUTCOME(S):

CO704-3. 1 Discuss digital image fundamentals.

CO704-3. 2 Apply image enhancement techniques.

CO704-3. 3 Use image restoration and segmentation Techniques.

CO704-3. 4 Use image compression Techniques.

CO704-3. 5 Represent features of images

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	3	3	3	3	2		1					3
CO302	3	3	2	2	2	1						3
CO303	3	2	3	2	2	2						3
CO304	3	3	3	2	2	2	2					3
CO305	3	3	3	1	1	2	3					3

1→Low 2→Medium 3→High

19EC7704 COGNITIVE RADIO L T P C
3 0 0 3

OBJECTIVES:

- To understand the evolving software defined radio and cognitive radio techniques and their essential functionalities.
- To study the basic architecture and standard for cognitive radio.
- To understand the physical, MAC and Network layer design of cognitive radio.
- To expose the student to evolving applications and advanced features of cognitive radio.

PRE-REQUISITE:

- Wireless Networks

UNIT I INTRODUCTION TO SOFTWARE-DEFINED RADIO AND COGNITIVE RADIO 9

Evolution of Software Defined Radio and Cognitive radio, Interoperability, Dynamic Spectrum Access, Evolution of Software Defined Radio and Cognitive radio-Architecture, Regulatory History and Successes, Emerging Regulatory Challenges and Actions, Spectrum Measurements and Usage, Spectrum Measurements and Usage, Applications for Spectrum Occupancy Data.

UNIT II COGNITIVE RADIO ARCHITECTURE 9

Functions, Components and Design Rules-Cognition cycle – orient, plan, decide and act phases, Building the CRA on SDR Architectures, Software Defined Radio Architectures for Cognitive Radios-SDR Architectures, Software Tunable Analog Radio Components, Overview of IEEE 802.22 standard for broadband wireless access in TV bands.

UNIT III SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS 9

Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection and other approaches, Fundamental Tradeoffs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio.

UNIT IV MAC AND NETWORK LAYER DESIGN FOR COGNITIVE RADIO 9

MAC for cognitive radios – Polling, ALOHA, slotted ALOHA, CSMA, CSMA / CA, Network layer design – routing in cognitive radios, flow control and error control techniques.

UNIT V ADVANCED TOPICS IN COGNITIVE RADIO 9

Overview of security issues in cognitive radios, auction based spectrum markets in cognitive radio networks, public safety and cognitive radio, cognitive radio for Internet of Things.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Alexander M. Wyglinski, Maziar Nekovee, Thomas Hou, "Cognitive Radio Communications and Networks", Academic Press, Elsevier, 2010. (Unit I to IV)
2. Huseyin Arslan (Ed.), "Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer, 2007. (Unit V)

REFERENCE BOOK(S):

1. Bruce Fette, "Cognitive Radio Technology", Newnes, 2006.
2. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive Radio Networks", John Wiley and Sons, 2009.
3. Ezio Biglieri, Professor Andrea J. Goldsmith, Dr Larry J. Greenstein, Narayan B. Mandayam, H. Vincent Poor, "Principles of Cognitive Radio", Cambridge University Press, 2012.

WEB RESOURCE(S):

- https://nptel.ac.in/courses/108/107/108107107/

COURSE OUTCOME(S):

CO704-4. 1 Gain knowledge on the design principles on software defined radio and cognitive radio

CO704-4. 2 Gain knowledge on the design principles cognitive radio architecture

CO704-4. 3 Develop the ability to design and implement algorithms for cognitive radio spectrum sensing and dynamic spectrum access

CO704-4. 4 Build experiments and projects with real time wireless applications

CO704-4. 5 Apply the knowledge of advanced features of cognitive radio for real world applications.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO401	3	3	3	3	2	1						3
CO401	3	3	3	3	2	1						3
CO401	3	3	3	3	2	1						3
CO401	3	3	3	3	2	1						3
CO401	3	3	3	3	2	1						3

1→Low 2→Medium 3→High

19EC7705 BLOCKCHAIN PRINCIPLES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic components of a blockchain
- To study the advantages and types of blockchain networks.
- To understand the various types of distributed consensus .
- To impart knowledge in cryptocurrency.
- To learn cryptocurrency regulation.

PRE-REQUISITE:

- Communication Networks

UNIT I BASICS OF BLOCKCHAIN 9

Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

UNIT II BLOCKCHAIN NETWORK 9

Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

UNIT III DISTRIBUTED CONSENSUS 9

Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

UNIT IV CRYPTOCURRENCY 9

History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

UNIT V CRYPTOCURRENCY REGULATION 9

Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

TOTAL: 45 PERIODS

TEXT BOOK(S):

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

REFERENCE BOOK(S):

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies.
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.

4. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

WEB RESOURCE(S):

- https://nptel.ac.in/courses/106/104/106104220/#
- https://nptel.ac.in/courses/106/104/106104220/#
- https://nptel.ac.in/courses/106/104/106104220/#
- https://nptel.ac.in/courses/106/104/106104220/#
- https://nptel.ac.in/courses/106/104/106104220/#

COURSE OUTCOME(S):

CO704-5. 1 Understand the basic components of a blockchain

CO704-5. 2 Understand the different types of blockchain networks.

CO704-5. 3 Understand the different types of distributed consensus

CO704-5. 4 To design a cryptocurrency.

CO704-5. 5 Design, build, and deploy securely interact.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO501	3	3	3	3	2	1						3
CO502	3	3	3	2	2	1						3
CO503	3	3	3	2	2	2						3
CO504	3	3	3	3	3	3	3					3
CO505	3	3	3	1	1	2	3					3

1→Low 2→Medium 3→High

19EC7706 INTERNET OF THINGS L T P C

3 0 0 3

OBJECTIVES:

- To understand characteristics and design of IoT.
- To gain knowledge in IoT design Methodology.
- To develop various applications using various IoT devices.
- To analyse the advancements of Internet in mobile Device, Cloud & Sensor Networks
- To understand the domain specific IoTs

PRE-REQUISITE:

- Microprocessor and Microcontroller Programming and Interfacing

UNIT I INTRODUCTION TO INTERNET OF THINGS 9

Internet of Things-Characteristics of IoT-Physical Design of IoT-Logical Design of IoT-IoT System Components, Levels and Deployment Templates: IoT Level -1, IoT Level -2, IoT Level -3, IoT Level -4, IoT Level -5, IoT Level -6.

UNIT II DESIGN METHODOLOGY 9

IoT Design Methodology-IoT systems management with NETCONF-YANG, Simple Network Management Protocol, IoT and M2M, SDN and NFV for IoT, IOT Design Specifications, Model, Level and view Specifications, Device & Component Integration, Application Development, Basic building blocks of an loT Device

UNIT III IOT PHYSICAL DEVICES AND ENDPOINTS 9

Basic Building Block of an IoT Device, Exemplary Device: Raspberry Pi, Interfaces, Programming Raspberry Pi with PYTHON, Other IoT Devices: pcDuino, BeagleBone Black, Cubieboard, Intel Galileo, Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming.

UNIT IV IOT PHYSICAL SERVERS AND CLOUD OFFERINGS 9

Introduction to Cloud Storage Models & Communication APIs, WAMP - AutoBahn for IoT, Xively Cloud for IoT, Django Architecture, Starting Development with Django, Amazon Web Services for IoT, Amazon EC2, Amazon AutoScaling, Amazon S3, Amazon RDS, Amazon DynamoDB, Amazon Kinesis, Amazon SQS, Amazon EMR, SkyNet IoT Messaging Platform..

UNIT V Domain Specific IoTs & CASE STUDIES 9

Home Automation, Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Cities- Smart Parking, Smart Lighting, Structural Health Monitoring, Surveillance, Environment- Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection, Retail- Inventory Management, Smart Payments, Smart Vending Machines, Logistics- Route Generation & Scheduling, Shipment Monitoring, Remote Vehicle Diagnostics, Agriculture- Smart Irrigation, Green House Control, Industry- Machine Diagnosis & Prognosis, Indoor Air Quality Monitoring, Health & Lifestyle, Wearable Electronics.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Arshdeep Bahga, Vijay Madisetti ―Internet of Things – A hands-on approach, Universities Press, 2015.
2. Olivier Hersent, David Boswarthick, Omar Elloumi - The Internet of Things: Key Applications and Protocols, Wiley, 2012.

REFERENCE BOOK(S):

1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley , 2013
2. Peter Waher - Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3, Packt, 2018.
3. Gaston C. Hillar - Internet of Things with Python, Packt, 2016.

WEB RESOURCE(S):

- https://nptel.ac.in/courses/108/108/108108098/
- https://www.coursera.org/learn/iot
- https://www.edx.org/course/introduction-to-the-internet-of-things-iot

COURSE OUTCOME(S):

CO705-1. 1 Identify the main components composing the Internet of Things

CO705-1. 2 Critically evaluate ethical and potential security issues related to the Internet of Things

CO705-1. 3 Implement new applications based on Raspberry Pi ,Intel Galileo and Arduino board

CO705-1. 4 Design IoT systems with Cloud environment

CO705-1. 5 Analyze applications of IoT in real time scenario

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	3	3	3	3	2							3
CO102	3	3	3	3	2	1						3
CO103	3	3	3	3	2	1						3
CO104	3	3	3	3	2	1						3
CO105	3	3	3	3	2	1						3

1→Low 2→Medium 3→High

19EC7707 ADVANCED DIGITAL SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- The student comprehends mathematical description and modelling of discrete time random signals.
- The student is conversant with important theorems and random signal processing algorithms.
- The student learns relevant figures of merit such as power, energy, bias and consistency.
- The student is familiar with estimation, prediction, filtering, multirate concepts and techniques.

PRE-REQUISITE:

- Discrete Time Signal Processing

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9

Discrete random processes – Ensemble averages – Wide sense stationary process – Properties - Ergodic process – Sample mean & variance - Auto-correlation and Auto-correlation matrices- Properties – White noise process – Weiner Khitchine relation - Power spectral density – Filtering random process – Spectral Factorization Theorem – Special types of Random Processes – AR,MA, ARMA Processes – Yule-Walker equations.

UNIT II SPECTRUM ESTIMATION 9

Bias and Consistency of estimators - Non-Parametric methods – Periodogram – Modified Periodogram – Barlett's method – Welch's mehod – Blackman-Tukey method – Parametric methods – AR, MA and ARMA spectrum estimation - Performance analysis of estimators.

UNIT III SIGNAL MODELING AND OPTIMUM FILTERS 9

Introduction- Least square method – Pade approximation – Prony's method – Levinson Recursion – Lattice filter - FIR Wiener filter – Filtering – Linear Prediction – Non Causal and Causal IIR Weiner Filter -– Mean square error – Discrete Kalman filter.

UNIT IV ADAPTIVE FILTERS 9

FIR Adaptive filters - Newton's steepest descent method – Widrow Hoff LMS Adaptive algorithm – Convergence – Normalized LMS – Applications – Noise cancellation - channel equalization – echo canceller – Adaptive Recursive Filters - RLS adaptive algorithm – Exponentially weighted RLS-sliding window RLS.

UNIT V MULTIRATE SIGNAL PROCESSING 9

Decimation - Interpolation – Sampling Rate conversion by a rational factor I/D – Multistage implementation of sampling rate conversion – Polyphase filter structures – Applications of multirate signal processing.

TOTAL HOURS: 45

TEXT BOOK(S):

1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Prentice Hall of India, New Delhi, 2005.
2. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, 2006.
3. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall, 1992.
4. S. Kay," Modern spectrum Estimation theory and application", Prentice Hall, Englehood Cliffs, NJ1988.
5. Simon Haykin, "Adaptive Filter Theory", Prentice Hall, Englehood Cliffs, NJ1986.
6. Sophoncles J. Orfanidis, "Optimum Signal Processing ", McGraw-Hill, 2000.

WEB RESOURCE(S):

- https://nptel.ac.in/courses/117/101/117101001/
- http://www.nptelvideos.in/2012/12/advanced-digital-signal-processing.html
- https://ggn.dronacharya.info/MTech_ECE/Downloads/QuestionBank/ISem/AdvancedDigitalSignalProcessing/ADSP_NPTEL_LINKS_12052016.pdf
- https://www.btechguru.com/prepare--anna-university--electronics-and-communication-engineering--advanced-digital-signal-processing--iir-filters--4--123

COURSE OUTCOME(S):

CO705-2. 1 Formulate time domain and frequency domain description of Wide Sense Stationary process in terms of matrix algebra and relate to linear algebra concepts

CO705-2. 2 State W-K theorem, spectral factorization theorem, spectrum estimation, bias and consistency of estimators.

CO705-2. 3 Wiener filtering, LMS algorithms, Levinson recursion algorithm, applications of adaptive filters

CO705-2. 4 Wiener filtering, LMS algorithms, Levinson recursion algorithm, applications of adaptive filters

CO705-2. 5 Describe multirate signal processing.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	3	3	2	2	1	1				2	3
CO202	3	3	3	2	2	1	2				2	2

CO203	3	3	3	2	1	2	2				1	2
CO204	3	3	3	2	2	2	2				3	1
CO205	3	3	3	1	1	2	2				1	3

1→Low 2→Medium 3→High

19EC7708 LOW POWER SOC DESIGN L T P C
3 0 0 3

OBJECTIVES:

- To know the sources of power consumption and power reduction methods
- To understand basic principle of System on Chip design
- To learn the design methodologies for memory, logic cores and analog cores
- To identify suitable techniques to validate the SoC design
- To analyze the testing methods available for different levels of testing

PRE-REQUISITE:

- VLSI System Design

UNIT I POWER DISSIPATION IN CMOS 9

Physics of power dissipation in CMOS FET devices – Hierarchy of limits of power – Sources of power consumption – Static Power Dissipation, Active Power Dissipation - Designing for Low Power, Circuit Techniques for Leakage Power Reduction - Basic principle of low power design, Logic level power optimization – Circuit level low power design.

UNIT II SYSTEM ON CHIP DESIGN 9

System tradeoffs and evolution of ASIC Technology - System on chip concepts and methodology - SoC design issues - SoC challenges and components - SoC Design Flow - On-chip buses

UNIT III DESIGN METHODOLOGY FOR MEMORY AND CORES 9

Design process for hard cores - Soft and firm cores - Designing with hard cores and soft cores - Core and SoC design examples - Embedded memories - Simulation modes - Specification of analog circuits - A/D converter - Phaselocated loops - High I/O.

UNIT IV DESIGN VALIDATION 9

Core level validation -Test benches - SoC design validation - Co simulation - hardware/ Software coverification. Case Study: Validation and test of systems on chip.

UNIT V SOC TESTING 9

SoC Test Issues - Testing of digital logic cores - Cores with boundary scan - Test methodology for design reuse - Testing of microprocessor cores - Built in self test method - testing of embedded memories. Case Study: Integrating BIST techniques for on-line SoC testing.

TOTAL HOURS: 45

TEXT BOOK(S):

1. J.Rabaey, ―Low Power Design Essentials (Integrated Circuits and Systems), Springer, 2009

2. Wayne Wolf, ―Modern VLSI Design – System – on – Chip Design, Prentice Hall, 3rd Edition, 2008.

REFERENCE BOOK(S):

1. J.B.Kuo & J.H.Lou, ―Low-voltage CMOS VLSI Circuits, Wiley, 1999.
2. A.Bellaowar & M.I.Elmasry, Low power Digital VLSI Design, Circuits and Systems, Kluwer, 1996.
3. Rochit Rajsunah, "System-on-a-chip: Design and Test", Artech House, 2007.
4. Prakash Raslinkar, Peter Paterson & Leena Singh, "System-on-a-chip verification: Methodology and Techniques", Kluwer Academic Publishers, 2000.
5. M.Keating, D.Flynn, R.Aitken, A, GibbonsShi, "Low Power Methodology Manual for System-on-Chip Design Series: Integrated Circuits and Systems", Springer, 2007.
6. A.Manzone, P.Bernardi, M.Grosso, M. Rebaudengo, E. Sanchez, M.S.Reorda, Centro Ricerche Fiat, "Integrating BIST techniques for on-line SoC testing, IEEE Symposium on On-Line Testing, 2005.
7. Ricardo Rels, "Design of System on Chip: Devices and Components" Springer, July 2004.

WEB RESOURCE(S):

- NPTEL SOC Design https://youtu.be/PRQXzjTrCJY

COURSE OUTCOME(S):

CO705-3. 1 Know the sources of power consumption and possible power reduction methods in CMOS

CO705-3. 2 Understand the basic principle of System on Chip design

CO705-3. 3 Learn the design methodologies for memory, logic cores and analog cores. Optimize the power in combinational and sequential logic machines for SoC Design

CO705-3. 4 Identify suitable techniques to validate the SoC design

CO705-3. 5 Analyze the testing methods available for different levels of testing

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	3	2		3	2	2	2					3
CO302	2	1	3	3	2	2	1					3
CO303	3	3	3	3	3	2						3
CO304	2	2	2	3	2	2	2					3
CO305	2	3	3	3	3	2	3					3

1→Low 2→Medium 3→High

19EC7709 MEMS AND NEMS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the concepts of micro and nano electromechanical devices
- To analyze the use of materials in micro fabrication
- To know the fabrication process of Microsystems
- To know the design concepts of micro sensors and micro actuators

- To introduce the concepts of quantum mechanics and nano systems

PRE-REQUISITE:

- Linear Integrated Circuits

UNIT I INTRODUCTION TO MEMS AND NEMS 9

Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Materials for MEMS and NEMS: Silicon, silicon compounds, polymers, metals.

UNIT II MEMS FABRICATION TECHNOLOGIES 9

Photolithography, Ion Implantation, Diffusion, Oxidation, CVD, Sputtering Etching techniques, Micromachining: Bulk Micromachining, Surface Micromachining, LIGA.

UNIT III MICRO SENSORS 9

MEMS Sensors: Design of Acoustic wave sensors, Vibratory gyroscope, Capacitive Pressure sensors, Case study: Piezoelectric energy harvester

UNIT IV MICRO ACTUATORS 9

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces, Case Study: RF Switch.

UNIT V INTRODUCTION TO NANO DEVICES & OPTICAL AND RF MEMS

Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nanorods based NEMS device: Gas sensor.Optical MEMS, - System design basics – Gaussian optics, matrix operations, resolution. Case studies- MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Mems – design basics, case study – Capacitive RF MEMS switch, performance issues.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Stephen Santeria,"Microsystems Design", Springer, 2016.
2. NadimMaluf,"An Introduction to Micro Electro Mechanical System Engineering, Artech House, 2004.
3. Tai Ran Hsu, "MEMS & Micro Systems Design, Manufacture and Nanoscale Engineering", John Wiley, New Jersy, 2008.

REFERENCE BOOK(S):

1. Chang Liu, "Foundations of MEMS", Pearson Education, 2012.
2. Sergey Edward Lyshevski, ―MEMS and NEMS: Systems, Devices, and Structures‖ CRC Press, 2002
3. Ai Qun Liu,"Photonic MEMS Devices", CRC press Bocaraton, 2009.

WEB RESOURCE(S):

- https://nptel.ac.in/courses/117/105/117105082/
- https://nptel.ac.in/courses/108/108/108108113/
- https://nptel.ac.in/courses/108/108/108108147/
- https://nptel.ac.in/courses/117/108/117108047/

COURSE OUTCOME(S):

CO705-4. 1 Interpret the basics of micro/nano electromechanical systems including their applications and advantages.

CO705-4. 2 Recognize the use of materials in micro fabrication.

CO705-4. 3 Describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.

CO705-4. 4 Analyze the key performance aspects of electromechanical transducers including sensors and actuators

CO705-4. 5 Comprehend the theoretical foundations of quantum mechanics and Nano systems

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO401	3	2	1	1								3
CO402	3	3	3	3	1	1	2					3
CO403	3	3	3	3	1	1	2					3
CO404	3	3	3	3	1	2	2					3
CO405	3	2	1	1								3

1→Low 2→Medium 3→High

19EC7710 HIGH SPEED COMMUNICATION NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- Students will get an introduction about ATM and Frame relay.
- Students will be provided with an up-to-date survey of developments in High Speed Networks.
- Enable the students to know techniques involved to support real-time traffic and congestion control.
- Students will get different levels of services.
- Students will be provided with different levels of quality of service (Q.S) to different applications.

PRE-REQUISITE:

- Communication Networks

UNIT I HIGH SPEED NETWORKS 9

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL, High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11

UNIT II CONGESTION AND TRAFFIC MANAGEMENT 8

Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

UNIT III TCP AND ATM CONGESTION CONTROL 11

TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO back off – KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management.

UNIT IV INTEGRATED AND DIFFERENTIATED SERVICES 8

Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services

UNIT V PROTOCOLS FOR QOS SUPPORT 9

RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.

TOTAL PERIODS: 45

TEXT BOOK:

1. William Stallings, "HIGH SPEED NETWORKS AND INTERNET", Pearson Education, Second Edition, 2002.

REFERENCES:

1. Warland, Pravin Varaiya, "High performance communication networks", Second Edition, Jean Harcourt Asia Pvt. Ltd., 2001.
2. Irvan Pepelnjk, Jim Guichard, Jeff Apcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003.
3. Abhijit S. Pandya, Ercan Sea, "ATM Technology for Broad Band Telecommunication Networks", CRC Press, New York, 2004.

WEB RESOURCE(S):

1. https://books.google.co.in/books/about/High_speed_Networks_and_Internets.html?id=fP1SAAAAMAAJ
2. https://calhoun.nps.edu/handle/10945/27988
3. https://www.slideshare.net/ayyakathir/unit1-29753217

COURSE OUTCOME(S):

CO705-5. 1 Discuss and study about ATM and Frame relay.

CO705-5. 2 Apply and study up-to-date survey of developments in High Speed Networks.

CO705-5. 3 Use real-time traffic and congestion control.

CO705-5. 4 Use different levels of services.

CO705-5. 5 Represent features of quality of service and its applications.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO501	3	3	3	3	2		1					3
CO502	3	3	2	2	2	1						3

CO503	3	2	3	2	2	2						3
CO504	3	3	3	2	2	2	2					3
CO505	3	3	3	1	1	2	3					3

1→Low 2→Medium 3→High

19EC8701 MULTIMEDIA COMPRESSION AND COMMUNICATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enrich in the fundamentals of multimedia coding and standards.
- To acquire knowledge in text coding.
- To acquire knowledge behind the theory of image and video coding & decoding with standards.
- To learn principles of audio coding and standards.
- To get comprehensive learning in multimedia communication and networking techniques

PRE-REQUISITE:

- Analog and Digital Communication, Communication Networks

UNIT I LOSSLESS AND LOSSYCODING 9

Components of Multimedia – Basics of Information Theory – Entropy – Lossless Compression – Text Compression – Run Length Coding – Variable Length Coding – Shannon Fano Coding – Huffman and Adaptive Huffman Coding – Dictionary Based Coding – Arithmetic Coding – Lossy Compression Algorithms – Rate Distortion Theory – Quantization – Transform Coding – Wavelet Based Coding.

UNIT II IMAGE PROCESSING AND CODING 9

Image Formation – CIE Chromaticity Diagram – Color Models: RGB, CMY, LMS, HSV, HSL – Color Balancing – Gamma Correction – Image Coding and Decoding Standards: JPEG, JPEG-2000, JPEG-LS, GIF, PNG, TIFF, BMP.

UNIT III VIDEO PROCESSING AND CODING 9

Video Color Transform: YUV, YIQ, YcbCr – Chroma Subsampling – Standard Digital Video Formats – CIF – QCIF – HDTV – UHDTV – Resolutions – 4K, 8K– Video Compression based on Motion Compensation – Search for Motion Vectors – H.261 – H.264 – Motion Compensation in MPEG – MPEG-1, MPEG-4, MPEG-7.

UNIT IV AUDIO PROCESSING AND CODING 9

Digitization of Audio: PCM, ADPCM – Waveform Audio File Format – Synthetic Sounds – Musical Instrument Digital Interface – Vocoders – MPEG Audio – MP-3 – Advance Audio Coding – High-Efficiency Advanced Audio Coding – MPEG-4 – Home Theatre Systems.

UNIT V MULTIMEDIA COMMUNICATIONS AND NETWORKING 9

Quality-of-Service for Multimedia Communications, Protocols for Multimedia Transmission and Interaction-Real-Time Transport Protocol, RTP Control Protocol, Real-Time Streaming Protocol, Content Distribution Networks (CDNs), Broadcast/Multicast Video-on-Demand ,HTTP-Based Media Streaming

TOTAL PERIODS: 45

TEXT BOOK(S):

1. Mark S. Drew, Zee Nian Li, "Fundamentals of Multimedia", Prentice Hall, 2014.

REFERENCE BOOK(S):

1. Ralf Steinmetz, Klara Nahrstedt, "Multimedia Computing, Communications, and Applications", Innovative Technology Series, Prentice Hall, 1995.
2. Jerry D. Gibson, Toby Berger, Tom Lookabaugh, Dave Lindergh, Richard L. Baker "Digital Compression for Multimedia: Principles and Standards", Elsevier, 2006.
3. Ranjan Parekh, "Principles of Multimedia", McGraw Hill Education, Second Edition, 2017.
4. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Pearson Education, 2002.

WEB RESOURCE(S):

- https://nptel.ac.in/courses/117/105/117105083/
- https://nptel.ac.in/courses/117/105/117105081/
- https://nptel.ac.in/courses/106/105/106105082/
- https://freevideolectures.com/course/2652/cse-40373-multimedia-systems

COURSE OUTCOME(S):

CO801-1. 1 Understand the concepts and techniques used in multimedia basics and develop competence in implementing text coding

CO801-1. 2 Design and implement algorithms for image processing and coding.

CO801-1. 3 Design and implement algorithms for video processing and coding.

CO801-1. 4 Choose and analyze suitable audio coding for a given multimedia application

CO801-1. 5 Understand the concepts in multimedia communication and networking techniques

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	3	3										
CO102	3	3		2	2	2	2	2	2	2		2
CO103	3	3	3					2	2	1		2
CO104	3	3	3			1	1	1	1	1		1
CO105	3	3		2	1	1	1	1	1	1		2

1→Low 2→Medium 3→High

19EC8702 TELECOMMUNICATION AND SWITCHING NETWORK SYSTEMS

L	T	P	C
3	0	0	3

- **OBJECTIVES:**
- To introduce major telecommunication network and various design parameters.
- To study the enhanced local loop systems in digital environment.
- To introduce ISDN, DSL / ADSL, and fiber optic systems in subscriber loop.

- To introduce statistical modeling of telephone traffic, blocking system characteristics and queuing system characteristics.
- To characterize blocking probability holding service time distributions for in speech and data networks.

PRE-REQUISITE:

- Analog and Digital Communication, Communication Networks

UNIT I EVOLUTION OF SWITCHING SYSTEM 9

Evolution of Telecommunications, Basic of Switching System, Simple Telephone Communication, Manual Switching System, Major Telecommunication Networks. Strowger, Rotary Dial Telephone, Signaling Tones, Step by Step Switching, Design Parameters, Crossbar Switching: Principal of Common Control, Touch Tone Dial Telephone and Principals of Crossbar Switching

UNIT II DIGITAL SWITCHING 9

Switching Functions, Space Division Switching, Time Division Switching, two dimensional Switching: STS Switching, TST Switching, No.4 ESS Toll Switch, Digital Cross- Connect Systems, Digital Switching in an Analog Environment. Elements of SS7 signaling.

UNIT III TRAFFIC ENGINEERING 9

Network Traffic Load And Parameters, Grade Of Service And Blocking Probability, Modeling Switching Systems, Incoming Traffic And Service Time Characterizations, Blocking Models And Loss Estimates, Delay Systems.

UNIT IV TELEPHONE NETWORKS 9

Subscriber Loop System, Switching Hierarchy And Routing, Transmission Plan, Transmission System Numbering Plan, Charging Plan, Signaling Techniques, In-channel Signaling, Common Channel Signaling, Cellular Mobile Telephony.

UNIT V DIGITAL SUBSCRIBER ACCESS 9

Cellular concept- Frequency reuse - channel assignment- hand off. Multiple Access techniques - FDMA, TDMA, CDMA. Spread spectrum– DSSS, FHSS. ISDN: ISDN Basic Rate Access Architecture, ISDN U Interface, ISDN D Channel Protocol. High-Data-Rate Digital Subscriber Loops: Asymmetric Digital Subscriber Line, VDSL. Digital Loop Carrier Systems: Universal Digital Loop Carrier Systems, Integrated Digital Loop Carrier Systems, Next-Generation Digital Loop Carrier, Fiber in the Loop, Hybrid Fiber Coax Systems, Voice band Modems: PCM Modems, Local Microwave Distribution Service, Digital Satellite Services.

TOTAL HOURS: 45

TEXT BOOK(S):

1. J. Bellamy, “Digital Telephony”, John Wiley, 3rd Edition, 2006.
2. JE Flood, “Telecommunications Switching, Traffic and Networks”, Pearson, 2016.
3. R.A.Thomson, “Telephone switching Systems”, Artech House Publishers, 2000.

REFERENCE BOOK(S):

1. T.N.Saadawi, M.H.Ammar, A.E.Hakeem, “Fundamentals of Telecommunication Networks”, Wiley Interscience, 1994.

2. W.D. Reeve, "Subscriber Loop Signaling and Transmission Hand book", IEEE Press (Telecomm Handbook Series), 1995.
3. Viswanathan. T., "Telecommunication Switching System and Networks", Prentice Hall of India Ltd., 1994.
4. James P. Martin, "Modern Telecommunication networks", PHI Publication.
5. W. Stalling, "Data and Computer Communications", Prentice Hall, 1993.

WEB RESOURCE(S):

1. https://nptel.ac.in/courses/117/105/117105076/
2. https://www.tutorialspoint.com/telecommunication_switching_systems_and_networks/index.htm
3. https://www.carritech.com/news/switching-systems-in-telecommunication-networks/

COURSE OUTCOME(S):

CO801-2. 1 Can find the applications of all the areas in day to day life.

CO801-2. 2 Can understand the concepts of space switching, time switching and combination switching

CO801-2. 3 Understand and outline network control and management issues.

CO801-2. 4 Can understand the operations, working, construction, material etc. aspects of link budget, losses, fading.

CO801-2. 5 Can analyse different areas of satellite communication.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	1		2							1	1
CO202	3	1										1
CO203	3	1		2		3	2	2	3		2	2
CO204	3	1				3	2				2	1
CO205	3	1		2	3	3	3		3		2	1

1→Low 2→Medium 3→High

19EC8703 MOBILE COMMUNICATIONS L T P C
3 0 0 3

OBJECTIVES:

- Learn basic propagation of radio waves.
- Learn the parameters of wireless channels.
- Study the cellular architecture
- Study the Multiple Access & modulation schemes.
- Know the Applications in IOT

PRE-REQUISITE:

- Analog and Digital Communication

UNIT I MOBILE RADIO PROPAGATION 9

Free space propagation model, Three basic propagation mechanisms, Reflection-Two-Ray model,

Diffraction – Knife-edge diffraction model, Scattering, Log-normal shadowing, Okumara model, Hata model, Log-distance path loss model.

UNIT II WIRELESS CHANNELS 9

Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters-Coherence bandwidth – Doppler spread & Coherence time, fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading

UNIT III CELLULAR ARCHITECTURE 9

Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity-trunking & grade of service – Coverage and capacity improvement.

UNIT IV MODULATION AND MULTIPLE ACCESS SCHEMES 9

OFDM, Spread Spectrum Systems-DSSS, FHSS, RAKE receiver, Access methods - FDMA, TDMA - CDMA -SDMA and CSMA, Diversity Techniques

UNIT V APPLICATIONS IN IOT 9

IoT System for weather monitoring-IoT System for home automation-Wi-Fi-controlled Mobile Robot - Remote Energy Monitoring and Control Device

TOTAL HOURS: 45

TEXT BOOK(S):

1. Rappaport,T.S., ―Wireless communications‖, Pearson Education, Second Edition, 2010. [Unit-1 to 4]
2. David Tse and Pramod Viswanath, ―Fundamentals of Wireless Communication‖, Cambridge University Press, 2010 .[Unit-1 to 4]
3. Honbo Zhou, ―The Internet of Things in the Cloud A Middleware Perspective‖, CRC Press, 2013. [Unit-5]
4. Adrain Mc Ewen, Hakim Cassimally, ―Designing the Internet of Things‖, Wiley, 2014. [Unit-5]

REFERENCE BOOK(S):

1. Kamilo Feher, ―Wireless Digital Communications, Modulation & Spread Spectrum Applications‖, PHI, 1999. [Unit-1 to 4]
2. Samuel Y. Lee, ―Mobile Communication Engineering‖, McGraw Hill, 1998. [Unit-1 to 4]
3. Andreas F. Molisch "Wireless Communications" Wiley-IEEE Press, Second Edition, 2010. [Unit-1 to 4]
4. Marco Schwartz, ―Internet of Things with the Arduino Yun‖, Packt Publishing, 2014. [Unit-5]
5. Arshdeep Bahga, Vijay K. Madisetti, ―Internet of Things A Hands-on Approach‖, VPT, 1st Edition, 2014. [Unit-5]

WEB RESOURCE(S):

- https://nptel.ac.in/courses/117106108/
- https://nptel.ac.in/courses/117/102/117102062/
- https://nptel.ac.in/courses/106/106/106106167/
- https://nptel.ac.in/courses/108/105/108105134/

- https://nptel.ac.in/courses/106/105/106105166/

COURSE OUTCOME(S):

CO801-3. 1 Understand the basic propagation mechanism of Radio Waves

CO801-3. 2 Understand the various channel parameters of wireless

CO801-3. 3 Understand the Cellular Architecture

CO801-3. 4 Understand the Modulation and Multiple Access schemes in Cellular Communication

CO801-3. 5 Understand the Applications in IOT.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	3	3	3	2							3
CO202	3	3	3	2	2	1						3
CO203	3	3	3	2	2	2						3
CO204	3	3	3	2	2	2	2					3
CO205	3	3	3	1	1	2	3					3

1→Low 2→Medium 3→High

19EC8704 EMBEDDED NETWORKS L T P C

3 0 0 3

OBJECTIVES:

- To be able to learn all the networking technologies applicable to embedded systems
- To learn all the communication protocols for networking
- To learn the currently trending technologies that apply embedded networking

PRE-REQUISITE:

- Microprocessors and Microcontrollers

UNIT I EMBEDDED COMMUNICATION PROTOCOLS 9

Introduction, Serial/Parallel communication: Serial communication protocols -RS232 standard – RS485, – Synchronous Serial Protocols: Serial Peripheral Interface (SPI), Inter Integrated Circuits (I2C), PC Parallel port programming, ISA/PCI Bus protocols, Fire wire.

UNIT II USB AND CAN BUS 9

USB bus : Introduction – Speed Identification on the bus – USB States , USB bus communication :Packets –Data flow types , A simple application with USB: Inkjet printer, CAN Bus:– Introduction - Frames –Bit stuffing –Types of errors –Nominal Bit Timing –CAN Interface –A simple application with CAN: Telephone exchange.

UNIT III ETHERNET BASICS 9

Elements of a network – Inside Ethernet – Building a Network: Hardware options – Cables, Connections and network speed – Design choices: Selecting components –Ethernet Controllers – Using the internet in local and internet communications – Inside the Internet protocol.

UNIT IV EMBEDDED ETHERNET 9

Exchanging messages using UDP and TCP, Serving web pages with Dynamic Data, Serving web pages that respond to user Input, Email for Embedded Systems, Using FTP, Keeping Devices and Network secure.

UNIT V WIRELESS EMBEDDED NETWORKING 9

Wireless sensor networks: Introduction – Applications – Network Topology – Localization –Time Synchronization, Energy efficient MAC protocols: SMAC, Energy efficient and robust routing, Data Centric routing.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Frank Vahid, Givargis 'Embedded Systems Design: A Unified Hardware/Software Introduction', Wiley Publications, 2006
2. Jan Axelson, 'Parallel Port Complete', Penram publications, 2006

REFERENCE BOOK(S):

1. Dogan Ibrahim, 'Advanced PIC microcontroller projects in C', Elsevier 2008
2. Jan Axelson 'Embedded Ethernet and Internet Complete', Penram publications
3. Bhaskar Krishnamachari, 'Networking wireless sensors', Cambridge press 2005

WEB RESOURCE(S):

- www.nptel.ac.in/courses/106103016

COURSE OUTCOME(S):

CO801-4. 1 Explain the serial and parallel communication protocol related to embedded networking.

CO801-4. 2 Discuss the concepts of USB & CAN bus.

CO801-4. 3 Familiarize the basics of Ethernet communication

CO801-4. 4 Explain the concepts of Embedded Ethernet.

CO801-4. 5 Recognize the need for wireless protocols to indulge in Real world interfacing.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO401	3	2	1							2	1	
CO402	3	2	2							2	2	
CO403	3	2	2								1	
CO404	3	2	2								2	
CO405	3	2	2							3		

1→Low 2→Medium 3→High

19EC8705 ASIC DESIGN L T P C
3 0 0 3

OBJECTIVES:

- To express the design flow, types and the programming technologies of an ASIC

- To prepare the student to be an entry-level industrial standard ASIC or FPGA designer.
- To analyze floor planning, placement and routing of design.
- To give the student an understanding of issues and tools related to ASIC/FPGA design and implementation.
- To give the student an understanding of basics of System on Chip and Platform based design.

PRE-REQUISITE:

- VLSI Design

UNIT I ASIC TYPES AND CONSTRUCTION 9

ASIC Design Flow, Types of ASIC - Full Custom, Semi Custom – Standard Cell Based ASIC and Gate Array ASIC, Programmable ASIC – PROM, PLA, PAL, CPLD, FPGA, Programming Technology – Antifuse, SRAM, EPROM, EEPROM,ASIC construction.

UNIT II SYSTEM PARTITIONING 9

Measurement of Partitioning, Partitioning Algorithms – Constructive Partitioning, Iterative Partitioning Improvement Algorithms - K-L Algorithm, FM algorithm, Ratio-Cut Algorithm, Look-Ahead Algorithm, Simulated Annealing, FPGA Partitioning, Power Dissipation.

UNIT III FLOORPLANNING AND PLACEMENT 9

Floor Planning Measurement and tools, I/O, Power and clock planning, Measurement of Placement, Placement Algorithms – Min-cut Placement, Eigen value Placement, Iterative Placement Improvement and Timing driven Placement algorithms.

UNIT IV ROUTING AND CIRCUIT EXTRACTION 9

Global Routing Measurement – Measurement of Interconnect Delay using Elmore‟s constant, Global routing for CBIC and GA, Detailed Routing Measurement - Measurement of Channel Density, Detailed routing Algorithms – LEA, Lee Maze and High tower Algorithms, Circuit extraction process, Layout Design Rules and Technology related issues.

UNIT V ASIC HIGH PERFORMANCE ALGORITHMS 9

High performance algorithms for ASICS/ SoCs as case studies – Canonic Signed Digit Arithmetic, KCM, Distributed Arithmetic, High performance digital filters for sigma-delta ADC, USB controllers, OMAP.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Michael John Sebastian Smith, " Applications Specific Integrated Circuits", Pearson Education, Ninth Indian reprint,13th edition,2004.
2. Farzad Nekoogar and Faranak Nekoogar, From ASICs to SOCs: A Practical Approach, Prentice Hall PTR, 2003.
3. Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR, 2004.

REFERENCE BOOK(S):

1. J.M.Rabaey, A. Chandrakasan, and B.Nikolic, "Digital Integrated Circuit Design Perspective (2/e)", PHI 2003
2. D. A.Hodges, "Analysis and Design of Digital Integrated Circuits (3/e)", MGH 2004
3. 3. Hoi-Jun Yoo, Kangmin Leeand Jun Kyong Kim, "Low-Power NoC for High-Performance SoC Design", CRC Press, 2008

WEB RESOURCE(S):

- https://nptel.ac.in/courses/106/105/106105161/
- https://nptel.ac.in/courses/106/106/106106088/

COURSE OUTCOME(S):

CO801-5. 1 Describe the design flow, types and the programming technologies of an ASIC and its construction.

CO801-5. 2 Apply partitioning algorithms to partition the network to meet the objectives.

CO801-5. 3 Apply floor planning & placement algorithms to place the logic cells inside the flexible blocks of an ASIC to meet the objectives.

CO801-5. 4 Apply routing algorithms to route the channels then describing various circuit extraction formats and Investigate the issues and discover solutions in each step of physical design flow of an ASIC.

CO801-5. 5 Appreciate high performance algorithms available for ASICs.

PO vs CO MAPPING

CO No	**PO_a**	**PO_b**	**PO_c**	**PO_d**	**PO_e**	**PO_f**	**PO_g**	**PO_h**	**PO_i**	**PO_j**	**PO_k**	**PO_l**
CO501	2	1			2			1	1	1	2	2
CO502	3	2	1		2			1	2	2	1	2
CO503	3	2	1		2			1	2	2		2
CO504	3	3	2	1	2			1	2	2		3
CO505	3	3	2	1	2			1	2	2		3

1→Low 2→Medium 3→High

OPEN ELECTIVE						
Code No.	**Course**	**L**	**T**	**P**	**C**	**H**
SEMESTER V						
19EC5801	Digital Electronics Fundamentals	3	0	0	3	3
19EC5802	Basic VLSI Design	3	0	0	3	3
19EC5803	Introduction to Signals and Systems	3	0	0	3	3
19EC5804	Communication Engineering	3	0	0	3	3
SEMESTER VI						
19EC6801	Introduction to Microprocessor and Microcontroller	3	0	0	3	3
19EC6802	TV and Video Engineering	3	0	0	3	3
19EC6803	Basics of Biomedical Engineering	3	0	0	3	3
19EC6804	Principles Of Electronic Communication	3	0	0	3	3
SEMESTER VII						
19EC7801	Digital Audio Engineering	3	0	0	3	3
19EC7802	Introduction to Mobile Communication	3	0	0	3	3
19EC7803	Data converters	3	0	0	3	3
19EC7804	Telemedicine	3	0	0	3	3
SEMESTER VIII						
19EC8801	Electronic Materials	3	0	0	3	3
19EC8802	Real Time Embedded System	3	0	0	3	3
19EC8803	Image Processing Essentials	3	0	0	3	3
19EC8804	Robotic Vision and Automation	3	0	0	3	3

19EC5801 DIGITAL ELECTRONICS FUNDAMENTALS

L	**T**	**P**	**C**
3	**0**	**0**	**3**

OBJECTIVES:

- To acquire basic knowledge of binary number systems.
- To apply concepts of Boolean algebra for handling logical expressions
- To understand working and realization of combinational circuits.
- To understand fundamental concepts of flip-flops.
- To understand fundamental concepts of registers and counters.

UNIT I NUMBER SYSTEMS 9

Number system and codes:Binary, octal, hexadecimal and decimal Number systems and their inter conversion, BCD numbers ,gray code, excess–3 code, cyclic code, code conversion, ASCII, EBCDIC

codes. Binary addition and subtraction, signed and unsigned binary numbers, 1's and 2's complement representation.

UNIT II BOOLEAN ALGEBRA 9

Basic logic circuits, Logic gates (AND, OR, NOT,Ex-OR, Ex-NOR and their truth tables,), Universal Gates, Laws of Boolean algebra, De-Morgan's theorem, Min term, Max term, POS, SOP, canonical forms, KMap, Simplification by Boolean theorems, don't care condition

UNIT III COMBINATIONAL LOGIC CIRCUITS 9

Combinational Logic: The Half adder, the full adder, subtractor circuit. Multiplxer de-multiplexer, encoders, decorder, BCD to seven segment Decorder.

UNIT IV SEQUENTIAL LOGIC CIRCUITS-I 9

Flip flop and Timing circuits:set-reset laches, D-flipflop, R-S flipflop, J-K Flip-flop, Master slave Flip flop, edge triggered flip-flop, T flip-flop,Flip flop conversion.

UNIT V SEQUENTIAL LOGIC CIRCUITS-II 9

Registers & Counters: Synchronous/Asynchronous counter, Up/down synchronous counter, application of counter, Serial in/Serial out shift register. Parallel in/Serial out shift register, Serial in/parallel out shift register, parallel in/ parallel out shift register, Bi-directional register.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Digital Fundamentals by Morris and Mano, PHI Publication.

REFERENCE BOOK(S):

1. Fundamental of digital circuits by A.ANANDKUMAR, PHI Publication.
2. Digital Fundamaentals by FLOYD & JAIN, Pearsons Publication.
3. Fundamentals of Logic Design by Charles H. Roth Thomson.

WEB RESOURCE(S):

1. https://nptel.ac.in/courses/117106114/

COURSE OUTCOME(S):

CO506-1. 1 Acquire basic knowledge of binary number systems.

CO506-1. 2 Apply concepts of Boolean algebra for handling logical expressions.

CO506-1. 3 Understand working and realization of combinational circuits.

CO506-1. 4 Understand fundamental concepts of flip-flops.

CO506-1. 5 Understand fundamental concepts of registers and counters.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	3	2					3					3
CO102	3		3	2		2	2					2
CO103	3		2	2			2					2
CO104	3						3					3

CO105	3						2					2

1→Low 2→Medium 3→High

19EC5802 BASIC VLSI DESIGN L T P C
3 0 0 3

OBJECTIVES:

- To provide the basic fundamentals of fabrication technology, generations of IC and speed, power consumptions of various fabrication technologies.
- To understand the knowledge of electrical properties of MOS circuits.
- To learn the design concepts of stick diagrams, layouts for various MOS technologies.
- To understand the concepts of design rules, scaling, subsystem design semiconductor IC design.
- To understand the synthesis, simulation design verification tools, CMOS testing.

UNIT I INTRODUCTION 9

An overview of wafer fabrication - Wafer processing - Oxidation - Patterning - Diffusion - Ion implantation - Deposition - Silicon gate nMOS process - CMOS processes - nWell - PWell - Twin tub - Silicon on insulator - CMOS process enhancements - Interconnect - Circuit elements

UNIT II BASIC ELECTRICAL PROPERTIES OF MOS 9

nMOS and PMOS transistors- Threshold voltage - Threshold voltage equations - MOS device equations - Basic DC equations - Second order effects

UNIT III INVERTER DESIGN 9

nMOS inverter - Depletion mode and enhancement mode pull ups – Pseudo nMOS Inverter - CMOS inverter –Transfer Characteristics – Noise Margins- Sheet resistance - Area Capacitance - Inverter delay – Power Dissipation- Need For Low Power

UNIT IV MOS CIRCUIT DESIGN PROCESSES 9

MOS layers – Stick diagrams – Design rules and layout – General observation on the design rules, 2μm double metal, double poly – CMOS rules, 1.2μm Double metal, Double poly CMOS rules – Layout diagrams of NAND and NOR gates and CMOS inverter – Symbolic Diagrams

UNIT V COMBINATIONAL MOS LOGIC CIRCUITS 9

Static CMOS logic - Pass transistor- transmission gate logic - NAND gate - NOR gate - Other forms of CMOS logic - Dynamic CMOS logic - Clocked CMOS logic - Precharged domino CMOS logic

TOTAL HOURS: 45

TEXT BOOK(S):

1. Neil H.E. Weste, David Money Harris “CMOS VLSI Design: A Circuits and Systems Perspective”, 4th Edition, Pearson , 2017
2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, “Digital Integrated Circuits: A Design perspective”, Second Edition, Pearson, 2016.

REFERENCE BOOK(S):

1. M.J. Smith, “Application Specific Integrated Circuits”, Addisson Wesley, 1997

2. Sung-Mo kang, Yusuf leblebici, Chulwoo Kim "CMOS Digital Integrated Circuits: Analysis & Design",4th edition McGraw Hill Education,2013
3. Wayne Wolf, "Modern VLSI Design: System On Chip", Pearson Education, 2007
4. R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India 2005.

COURSE OUTCOME(S):

CO506-2. 1 Ability to demonstrate the fundamentals of IC technology such as various MOS fabrication technologies.

CO506-2. 2 Electrical Ability to calculate properties of MOS circuits such as Ids – Vds relationship, Vt, figure of merit.

CO506-2. 3 Ability to design an inverter with low power.

CO506-2. 4 Express the Layout of simple MOS circuit using Lambda based design rules.

CO506-2. 5 Ability to design a combinational logic circuit with optimized way.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	3	2	1								1
CO202	3	3	2	1								1
CO203	3	3	2	1								1
CO204	3	3	2	1								1
CO205	3	3	2	1								1

1→Low 2→Medium 3→High

19EC5803 INTRODUCTION TO SIGNALS AND SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- Understanding the fundamental characteristics of signals and systems.
- Understanding signals and systems in terms of both the time and transform domains.
- To analyze continues & discrete time signals and system in the Laplace and Z transform.

UNIT I SIGNALS AND SYSTEMS 9

Continuous and discrete time signals, Transformation of the independent variable, Exponential and sinusoidal signals, Impulse and unit step functions, Continuous-Time and Discrete-Time Systems

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Aperiodic signals, Periodic signals, Properties of Fourier transform and Fourier Transform for signals, Properties of Laplace transforms and Laplace transforms for signals

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 9

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Baseband signal Sampling – Z Transform, Inverse Z Transform, Properties of the Z Transform, Z Transform Pairs, Z Transform for signals

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 9

Impulse response – Difference equations-Convolution sum- Z Transform Analysis of Recursive & Non-Recursive systems

TOTAL HOURS: 45

TEXT BOOK(S):

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson, 2015.

REFERENCE BOOK(S):

1. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, "Signals & Systems - Continuous and Discrete", Pearson, 2007.
3. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.

COURSE OUTCOME(S):

CO506-3. 1 Be able to describe signals mathematically and understand how to perform mathematical operations on signals.

CO506-3. 2 Apply Laplace transform, Fourier transform for continuous time signals.

CO506-3. 3 Analyze LTI system through Laplace transform.

CO506-3. 4 Apply Z transform for discrete time LTI signal.

CO506-3. 5 Analyze discrete time LTI systems using Z transform.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	3	3	2	1								1
CO302	3	3	2	1								1
CO303	3	3	2	1								1
CO304	3	3	2	1								1
CO305	3	3	2	1								1

1→Low 2→Medium 3→High

19EC5804 COMMUNICATION ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To introduce different methods of analog communication and their significance
- To introduce Digital Communication methods for high bit rate transmission
- To learn Data and pulse communication systems
- To be familiar with source and error control coding.
- To gain knowledge on multi user communication

UNIT I ANALOG COMMUNICATION 9

Introduction to Communication Systems, Modulation – Types - Need for Modulation. Theory of Amplitude Modulation - Evolution and Description of SSB Techniques - Theory of Frequency and Phase Modulation – Comparison of various Analog Communication System (AM – FM – PM).

UNIT II DIGITAL COMMUNICATION 9

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Minimum Shift Keying (MSK) –Phase Shift Keying (PSK) – BPSK – QPSK ,Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

UNIT III DATA AND PULSE COMMUNICATION 9

Data Communication: History of Data Communication - Standards Organizations for Data Communication- Data Communication Circuits - Data Communication Codes - Error Detection and Correction Techniques - Data communication Hardware - serial and parallel interfaces. Pulse Communication**:** Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of various Pulse Communication System (PAM – PTM – PCM).

UNIT IV SOURCE AND ERROR CONTROL CODING 9

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes, convolution codes, viterbi decoding algorithm.

UNIT V MULTI-USER RADIO COMMUNICATION 9

Advanced Mobile Phone System (AMPS) - Global System for Mobile Communications (GSM) - Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Hand off - Overview of Multiple Access Schemes - Satellite Communication - Bluetooth.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Taub & Schiling “Principles of Communication Systems” Tata McGraw Hill 2007.
2. J.Das “Principles of Digital Communication” New Age International, 1986.
3. Wayne Tomasi, “Advanced Electronic Communication Systems”, 6th Edition, Pearson Education, 2009.

REFERENCE BOOK(S):

1. Kennedy and Davis “Electronic Communication Systems” Tata McGraw hill, 4th Edition, 1993.
2. Sklar “Digital Communication Fundamentals and Applications“ Pearson Education, 2001.
3. B.P.Lathi “Modern Digital and Analog Communication Systems” Oxford University Press, 1998.
4. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley & Sons, 2004
5. Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2007
6. H.Taub, D L Schilling and G Saha, “Principles of Communication”, 3rd Edition, Pearson Education, 2007.
7. B.Sklar, “Digital Communication Fundamentals and Applications” 2nd Edition Pearson Education 2007.

WEB RESOURCE(S):

1. https://ngss.nsta.org/Resource.aspx?ResourceID=986
2. http://www.umsl.edu/~joshik/msis480/chapt07.htm
3. gitahttps://www.sciencebuddies.org/teacher-resources/lesson-plans/analog-vs-dil-signals

COURSE OUTCOME(S):

CO506-4. 1 Apply Analog communication techniques.

CO506-4. 2 Apply Digital Communication techniques.

CO506-4. 3 Use data and pulse communication techniques.

CO506-4. 4 Analyze Source and Error control coding.

CO506-4. 5 Utilize multi-user radio communication.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO501	3	3	3	3	3					3	3	3
CO502	3	3	3	3	3					2	2	2
CO503	3	3	3	3	3					2	2	2
CO504	3	3	3	3	3					3	3	3
CO505	3	3	3	3	3					2	2	2

1→Low 2→Medium 3→High

19EC6801 INTRODUCTION TO MICROPROCESSOR AND MICROCONTROLLER

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Architecture of µP8085
- Addressing modes & instruction set of 8085.
- Architecture of µC 8051
- Need & use of Interfacing with 8085 & 8051
- Simple applications development with programming 8085 & 8051

UNIT I 8085 PROCESSOR 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 9

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up tability - Subroutine instructions - stack.

UNIT III 8051 MICRO CONTROLLER 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts- Data Transfer, Manipulation, Control Algorithms& I/O instructions, Comparison to Programming concepts with 8085.

UNIT IV PERIPHERAL INTERFACING 9

Study on need, Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254, 8279, - A/D and D/A converters &Interfacing with 8085& 8051.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Simple programming exercises- key board and display interface –Control of servo motor- stepper motor control- Application to automation systems.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Sunil Mathur &Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt. Ltd, 2016.
2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.

REFERENCE BOOK(S):

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007
2. Douglas V.Hall, 'Microprocessor and Interfacing', McGraw Hill Edu, 2016.

COURSE OUTCOME(S):

CO605-1. 1 Ability to explain the architecture of Microprocessor

CO605-1. 2 Ability to acquire knowledge in Addressing modes & instruction set of 8085 and to write the assembly language programme.

CO605-1. 3 Ability to explain the architecture of Microprocessor and Microcontroller and to write the assembly language programme.

CO605-1. 4 Ability to understand the importance of Interfacing

CO605-1. 5 Ability to develop the Microprocessor and Microcontroller based applications.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	3											
CO102	3	2			3					3		2
CO103	3											
CO104	3	2		3						3		
CO105	3	2	3	3	3	2				3	3	3

1→Low 2→Medium 3→High

19EC6802 TV AND VIDEO ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Understand the basics of satellite Networks\ To study the analysis and synthesis of TV Pictures, Composite Video Signal, Receiver Picture Tubes and Television Camera Tubes
- To study the principles of Monochrome Television Transmitter and Receiver systems
- To study the various Colour Television essentials and Colour Television systems
- To study the advanced topics in Television systems and Video Engineering

UNIT I TELEVISION FUNDAMENTALS 9

Geometry form and Aspect Ratio - Image Continuity - Interlaced scanning - Camera tubes-monochrome picture tubes- composite video signal- Picture signal transmission – positive and negative modulation – VSB transmission -sound signal transmission-standard Channel bandwidth

UNIT II MONOCHROME TELEVISION 9

TV transmitter–TV signal propagation–Interference–TV transmission Antennas – Monochrome TV receiver–RF tuner–UHF, VHF tuner-Digital tuning techniques-AFT-IF -subsystems-AGC– Noise cancellation- DC re-insertion-Video amplifier circuits-Sync -separation–EHT generation – Receiver Antennas

UNIT III COLOUR TELEVISION ESSENTIALS 9

Compatibility – colour perception- Three colour theory- luminance, hue and saturation-colour television cameras- values of luminance and colour difference signals- colour television display tubes- delta gun-precision-in-line and Trinitron colour picture tubes- purity and convergence- pincushion correction techniques- automatic degaussing -circuit- grey scale tracking – colour signal transmission- bandwidth-modulation of colour difference signals – weighting factors- Formation of chrominance signal;

UNIT IV COLOUR TELEVISION SYSTEMS 9

NTSC colour TV system- NTSC colour receiver- limitations of NTSC system – PAL colour TV system – Cancellation of phase errors- PAL –D colour system- PAL coder – Pal-D colour receiver- chromo signal amplifier- Separation of U and V signals- Colour burst separation – Burst phase Discriminator – ACC amplifier- Reference Oscillator- Ident and colour killer circuits- U and V demodulators- RO phase shift and 180^{o}PAL–Switch circuitry -Colour signal matrixing – merits and demerits of the PAL system – SECAM system – Coder and Decoder - merits and demerits of SECAM system

UNIT V ADVANCED TELEVISION SYSTEMS 9

Satellite TV technology-Cable TV– Digital television– Transmission and reception- Projection Television–Flat panel display TV receiver—3D TV – EDTV–Digital equipment's for TV -studios-HDTV-Remote control circuits, MATV, CATV and CCTV systems, LED TV, LCD TV, Curved Television. Plasma Display

TOTAL HOURS: 45

TEXT BOOK(S):

1. A.M. Dhake, "Television and Video Engineering", McGraw Hill Publications. 2008.

2. R.R. Gulati, "Monochrome and Colour TV", New Age International Publication, 2008.

REFERENCE BOOK(S):

1. S.P. Bali, "Colour Television Theory and Practice", TMH, 2008.
2. R.R. Gulati, "Modern Television Practice – Principles, Technology and Service", New Age International Publication, 2008.
3. B. Grob and C.E. Herndon, "Basic Television and Video Systems", McGraw Hill, 2008.

WEB RESOURCE(S):

1. http://nptel.ac.in/courses
2. https://ieeexplore.ieee.org/document/7366687
3. https://ieeexplore.ieee.org/document/6784055

COURSE OUTCOME(S):

CO605-2. 1 Describe the fundamentals of analysis and synthesis of TV pictures, Composite video signal, picture tubes and television camera tubes.

CO605-2. 2 Associate the working principles of monochrome television transmitter and Receiver systems.

CO605-2. 3 Define the terminologies associated with colour TV systems.

CO605-2. 4 Demonstrate the applications of television and other latest Television related developments.

CO605-2. 5 Engage in self-study and to cite the current application trends and new directions in the digital Television systems.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	2			2								2
CO202	2	1	2	2								2
CO203	2	1	2	2							2	2
CO204	2	1	2	2							2	2
CO205	2	1	2	2								2

1→Low 2→Medium 3→High

19EC6803 BASICS OF BIOMEDICAL ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To study about the different bio potential and its propagation.
- To understand the different types of electrodes and its placement for various recording.
- To study the design of bio amplifier for various physiological recording.
- To learn the different measurement techniques for non-physiological parameters.
- To familiarize the different biochemical measurements.

UNIT I BIO POTENTIAL GENERATION AND ELECTRODES TYPES 9

Origin of bio potential and its propagation. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - measurement with two electrodes

UNIT II BIOSIGNAL CHARACTERISTICS AND ELECTRODECONFIGURATIONS 9

Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven‟s triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode.

UNIT III SIGNAL CONDITIONING CIRCUITS 9

Need for bio-amplifier - differential bio-amplifier, Impedance matching circuit, isolation amplifiers, Power line interference, Right leg driven ECG amplifier, Band pass filtering

UNIT IV MEASUREMENT OF NON-ELECTRICALPARAMETERS 9

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods - Auscultatory method, direct methods: electronic manometer, Systolic, diastolic pressure, Blood flow and cardiac output measurement: Indicator dilution, and dye dilution method, ultrasound blood flow measurement.

UNIT V BIO-CHEMICAL MEASUREMENT 9

Blood gas analyzers and Non-Invasive monitoring, colorimeter, Sodium Potassium Analyser, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description).

TOTAL HOURS: 45

TEXT BOOK(S):

1. Leslie Cromwell, “Biomedical Instrumentation and measurement”, Prentice hall of India, New Delhi, 2007.
2. John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, New York, 2015.

REFERENCE BOOK(S):

1. Myer Kutz, “Standard Handbook of Biomedical Engineering and Design”, McGraw Hill Publisher, 2003.
2. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 2003.(Units II & IV)
3. Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, Pearson Education, 2004.
4. K.R.Valluvan, B.S. Sharomena Aarthi,"Medical Electronics", Charulatha publicatitons, 201

COURSE OUTCOME(S):

CO605-3. 1 To Learn the different bio potential and its propagation.

CO605-3. 2 To get Familiarize the different electrode placement for various physiological recording

CO605-3. 3 Students will be able design bio amplifier for various physiological recording.

CO605-3. 4 Students will understand various technique non electrical physiogical measurements.

CO605-3. 5 Understand the different biochemical measurements.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301				2		3						

CO302				2		3						
CO303	2	2	2	2	1	3						
CO304			3	2	1	3						
CO305			3	2	2	3						

1→Low 2→Medium 3→High

19EC6804 PRINCIPLES OF ELECTRONIC COMMUNICATION L T P C
3 0 0 3

OBJECTIVES:

- Learn basic electric fundamental circuits.
- Learn the semiconductor theory and pn junction.
- Study the characteristics of special semiconductors and power devices
- Learn the various modulations and it's techniques
- Know the concept of Cellular Architecture and spread spectrum

UNIT I ELECTRIC CIRCUIT FUNDAMENTALS 9

Ohm's Law – Kirchhoff's laws-Mesh Analysis –Network theorems -Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power Transfer Theorem, Nodal Analysis. AC Circuits-series and parallel of RLC circuits.

UNIT II SEMICONDUCTOR THEORY 9

Semiconductor-Intrinsic, Extrinsic-P-type/N-type, PN junction diode-Forward bias, Reverse Bias, v-i characteristics, Full wave Rectifier, zener diode-voltage regulation, Breakdown Mechanism, BJT-NPN,PNP Transistor[working principle].

UNIT III SPECIAL SEMICONDUCTOR & POWER DEVICES 9

Varactor diode –Tunnel diode- LASER diode, LED-7segment display, LDR, Photo-transistor, Opto-Coupler, Solar cell, CCD, SCR, Diac, Triac.

UNIT IV MODULATION TECHNIQUES 9

Modulation-Needs of modulation, types. Amplitude Modulation- DSBFC, DSBSC, SSSC, VSB [signal representation & spectrum]- AM-Superheterodyne Receiver. Angle Modulation-concepts of PM & FM [signal representation & Waveform].

UNIT V CELLULAR CONCEPT 9

Cellular concept- Frequency reuse - channel assignment- hand off. Multiple Access techniques - FDMA, TDMA, CDMA. Spread spectrum– DSSS, FHSS.

OTAL HOURS: 45

TEXT BOOK(S):

1. V Mittle and Arvind Mittle "Basic Electrical Engineering" Tata McGraw- Hill, Second Edition, 2017.[unit-1]
2. David A. Bell "Electronic Devices and Circuits" Fifth Edition, Oxford University Press, 2008. [unit-2,3]

3. J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems", Pearson Education 2014. [unit-4]
4. Rappaport,T.S., "Wireless communications", Pearson Education, Second Edition, 2010.[unit-5]

REFERENCE BOOK(S):

1. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", McGraw Hill Science Engineering, Eighth Edition, 11th Reprint 2016. [unit-1]
2. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, "Electronic Devices and circuits", Third Edition, Tata McGraw- Hill, 2008.[unit-2,3]
3. Herbert Taub, Donald L. Schilling, Goutam Saha "Principles of Communication Systems" Tata McGraw- Hill, Fourth Edition, 2017[unit-4]
4. Andreas F. Molisch "Wireless Communications" Wiley-IEEE Press, 2nd Edition, 2010. [unit-5]

WEB RESOURCE(S):

- https://nptel.ac.in/courses/117106108/
- https://nptel.ac.in/courses/117103063/
- https://nptel.ac.in/courses/108104091/
- https://nptel.ac.in/courses/106/106/106106167/

COURSE OUTCOME(S):

CO605-4. 1 Understand and analyze the V-I characteristics of AC and DC circuits.

CO605-4. 2 Understand the semiconductors and it's behaviours at PN junction devices.

CO605-4. 3 Recognize the various special semiconductor devices and learn to choose appropriate applications.

CO605-4. 4 Understand the Modulation needs and various techniques in communication.

CO605-4. 5 Describe the working principle of cellular technology and Multiple access in wireless communication.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO401	3	3	3	3	2							3
CO402	3	3	3	2	2	1						3
CO403	3	3	3	2	2	2						3
CO404	3	3	3	2	2	2	2					3
CO405	3	3	3	1	1	2	3					3

1→Low 2→Medium 3→High

19EC7801 DIGITAL AUDIO ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concept of fundamentals of digital audio.
- To understand the concept of audio in digital TV broadcasting.
- To understand the various codes of digital coding.
- To understand the concept of digital audio tape recorder.
- To analyze the concept internet audio in digital audio engineering.

UNIT I FUNDAMENTALS OF DIGITAL AUDIO 9

Discrete time sampling - sampling theorem - Nyquist frequency – aliasing – prevention – quantization – signal to error ratio – distortion – other architectures – dithers – types of dither.

UNIT II RECORDING AND TRANSMISSION PRINCIPLES 9

PCM – record processing – recording oriented codes – transmission oriented codes – audio in digital TV broadcasting – DAB.

UNIT III DIGITAL CODING & COMPRESSION 9

Block & convolutional codes – cyclic codes – Reed Solomon codes – interleaving – compression principles – lossless & perceptive coding – subband codes – transform coding – compression formats – MPEG audio – Dolby AC 3 – ATRAC.

UNIT IV DIGITAL AUDIO TECHNIQUES 9

Digital audio tape recorder – cassettes – modes – track format – digital audio editing – editing with random access media & recording media – editor structure – digital audio in optical disks – CD, MD, DVD, playing optical disk – Minidisk.

UNIT V APPLICATIONS OF DIGITAL AUDIO 9

Internet audio – MP3 – SDMI – audio MPEG 4 – PC – MIDI – sound cards.

TOTAL HOURS: 45

TEXT BOOK(S):

1. John Watkinson, "An Introduction to Digital Audio", Focal Press, Second edition. 2013
2. Ken C Pohlmann, "Principles of Digital audio", McGraw Hill, Sixth edition, 2010

REFERENCE BOOK(S):

1. Then Ballin, " Handbook for sound Engineers Taylor & Francis", Fifth edition, 2015
2. John Watkinson, "The art of Digital Audio" Focal Press, Third edition, 2013

WEB RESOURCE(S):

- https://nptel.ac.in/courses/117/105/117105145/

COURSE OUTCOME(S):

CO706-1. 1 Analyze the type of dither.

CO706-1. 2 Analyze the recording and transmission principles in digital audio.

CO706-1. 3 Analyze the various compression techniques.

CO706-1. 4 Design and analyze the digital audio editing.

CO706-1. 5 Analyze the various application of digital audio.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101		3		3		3						
CO102		3		3		3						
CO103	3	3	3	3	3	3						
CO104		3	3	3	3	3						

CO105		3	3	3	3	3						

1→Low 2→Medium 3→High

19EC7802 INTRODUCTION TO MOBILE COMMUNICATIONS L T P C
3 0 0 3

OBJECTIVES:

- Learn basic propagation mechanism of radio waves.
- Study the characteristics of cellular architecture
- Study the Multiple Access & modulation schemes.
- Learn OFDM-MIMO systems
- Introduce to 5G communication

UNIT I PROPAGATION MECHANISM OF RADIO WAVES 9

Three basic propagation mechanisms, Free space propagation model, Reflection-Two-Ray model, Diffraction, Scattering, Small scale fading

UNIT II CELLULAR ARCHITECTURE 9

Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity-– Coverage and capacity improvement.

UNIT III MODULATION AND MULTIPLE ACCESS SCHEMES 9

Spread Spectrum Systems-DSSS, FHSS, RAKE receiver, Access methods - FDMA, TDMA - CDMA - SDMA and CSMA, Diversity Techniques

UNIT IV OFDM-MIMO 9

MIMO : overview, BLAST Architecture, Space–Time Coding, Multi-Carrier Transmission, Orthogonal Frequency Division Multiplexing (OFDM), Advantages and Drawbacks of OFDM, Applications and Standards Multi-Carrier Modulation and Demodulation

UNIT V INTRODUCTION & ROAD MAP TO 5G 9

Historical trend and evolution of LTE technology to beyond 4G – Key building blocks of 5G – 5G use cases and System Concepts – The 5G Architecture – IoT: relation to 5G.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Rappaport,T.S., ―Wireless communications‖, Pearson Education, Second Edition, 2010. [Unit-1 to 3]
2. David Tse and Pramod Viswanath, ―Fundamentals of Wireless Communication‖, Cambridge University Press, 2010 .[Unit-1 to 4]
3. Claude Oestges Bruno Clerckx, MIMO Wireless Communications, Academic Press , 1st Edition ISBN: 9780123725356 [Unit-4]
4. Wei Xiang, Kan Zheng, Xuemin (Sherman) Shen, - 5G Mobile Communications, Springer, 2017. [Unit-V]

5. Afif Osseiran, Jose F. Monserrat and Patrick Marsch, - 5G Mobile and Wireless Communications Technology, Cambridge University Press, 2016 [Unit-V]

REFERENCE BOOK(S):

1. Kamilo Feher, ―Wireless Digital Communications, Modulation & Spread Spectrum Applications‖, PHI, 1999. [Unit-1 to 3]
2. Samuel Y. Lee, ―Mobile Communication Engineering‖, McGraw Hill, 1998. [Unit-1 to 3]
3. Andreas F. Molisch "Wireless Communications" Wiley-IEEE Press, Second Edition, 2010. [Unit-1 to 3]
4. Yong Soo Cho, Jaekwon Kim, Won Young Yang, Chung G. Kang, MIMO-OFDM Wireless Communications with MATLAB, Wiley-IEEE Press , 2010 [Unit-4]
5. H. Bouml lcskei , D. Gesbert , C. B. Papadias , A.-J. van der Veen, Space-Time Wireless Systems: From Array Processing to MIMO Communications, Cambridge University Press , ISBN:052185105X [Unit-4]
6. Jonathan rodriguez, - Fundamentals of 5G mobile networks, John Wiley & Sons, Ltd, 2015. [Unit-5]

WEB RESOURCE(S):

- https://nptel.ac.in/courses/117106108/
- https://nptel.ac.in/courses/117/102/117102062/
- https://nptel.ac.in/courses/117/104/117104115/
- https://nptel.ac.in/courses/108/105/108105134/
- https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ee36/

COURSE OUTCOME(S):

CO706-2. 1 Understand the basic propagation mechanism of Radio Waves

CO706-2. 2 Understand the Cellular Architecture

CO706-2. 3 Understand the Modulation and Multiple Access schemes in Cellular Communication

CO706-2. 4 Understand wireless communication with multicarrier Technologies

CO706-2. 5 Understand the basics of 5G technologies

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	3	3	3	2							3
CO202	3	3	3	2	2	1						3
CO203	3	3	3	2	2	2						3
CO204	3	3	3	2	2	2	2					3
CO205	3	3	3	1	1	2	3					3

1→Low 2→Medium 3→High

19EC7803 DATA CONVERTERS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Learn the sample and hold circuit

- Explain the concept of capacitor circuit and comparator
- To explain the basic operational and design principles of Digital to Analog converter architectures.
- To introduce the design calculations for developing the typical CMOS AD or DA converter.
- To make students decide the dimensions and bias conditions of all the MOS transistors involved in the design.

UNIT I SAMPLE AND HOLD CIRCUITS 9

Sampling switches, Conventional open loop and closed loop sample and hold architecture, Open loop architecture with miller compensation, multiplexed input architectures, recycling architecture switched capacitor architecture.

UNIT II SWITCH CAPACITOR CIRCUITS AND COMPARATORS 9

Switched-capacitor amplifiers, switched capacitor integrator, switched capacitor common mode feedback. Single stage amplifier as comparator, cascaded amplifier stages as comparator, latched comparators.

UNIT III DIGITAL TO ANALOG CONVERSION 9

Performance metrics, reference multiplication and division, switching and logic functions in AC, Resistor ladder DAC architecture, current steering DAC architecture.

UNIT IV ANALOG TO DIGITAL CONVERSION 9

Performance metric, Flash architecture, Pipelined Architecture, Successive approximation architecture, Time interleaved architecture.

UNIT V PRECISION TECHNIQUES 9

Comparator offset cancellation, Op Amp offset cancellation, Calibration techniques, range overlap and digital correction. **TOTAL HOURS: 45**

TEXT BOOK(S):

1. Behzad Razavi, “Principles of data conversion System Design”, IEEE press, 1995.

REFERENCE BOOK(S):

1. Franco Maloberti, “Data Converters”, Springer, 2007.
2. Rudy Van de Plassche, “CMOS Integrated Analog-to-Digital and Digital-to-Analog Converters”, Kluwer Acedamic Publishers, Boston, 2003. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013

WEB RESOURCE(S):

- https://www.slideshare.net/RahulSrivastava15/sample-and-hold-circuit-14789501
- https://nptel.ac.in/courses/108/105/108105132/
- http://www.digimat.in/nptel/courses/video/117108038/L38.html
- https://nptel.ac.in/courses/117/108/117108038/
- https://nptel.ac.in/courses/108/101/108101091/

COURSE OUTCOME(S):

CO706-3. 1 Explain sample and hold circuits

CO706-3. 2 Understand the concept of capacitor circuit and comparator.

CO706-3. 3 Design ADC/DAC circuits

CO706-3. 4 Analyze ADC/DAC Architecture and Performance

CO706-3. 5 Discuss calibration techniques

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	3	3	2	3	2						1	3
CO302	3	3	3	2	2	1					1	3
CO303	3	3	3	2	2						2	3
CO304	3	3	3	3	2	1					2	3
CO305	3	3	2	2	1	1					2	3

1→Low 2→Medium 3→High

19EC7804 TELEMEDICINE L T P C
3 0 0 3

OBJECTIVES:

- Learn the key principles for telemedicine and health.
- Understand telemedical technology.
- Know telemedical standards, mobile telemedicine and it applications

UNIT I FUNDAMENTALS OF TELEMEDICINE 9

History of telemedicine, definition of telemedicine, tele-health, tele-care, scope, Telemedicine Systems, benefits & limitations of telemedicine.

UNIT II TYPE OF INFORMATION & COMMUNICATION INFRASTRUCTURE FOR TELEMEDICINE 9

Audio, video, still images, text and data, fax-type of communications and network: PSTN, POTS, ANT, ISDN, internet, air/ wireless communications, GSM satellite, micro wave, Mobile health and ubiquitous healthcare.

UNIT III ETHICAL AND LEGAL ASPECTS OF TELEMEDICINE 9

Confidentiality, patient rights and consent: confidentiality and the law, the patient-doctor relationship, access to medical records, consent treatment - data protection & security, jurisdictional issues, intellectual property rights.

UNIT IV PICTURE ARCHIVING AND COMMUNICATION SYSTEM 9

Introduction to radiology information system and ACS, DICOM, PACS strategic plan and needs assessment, technical Issues, PACS architecture.

UNIT V APPLICATIONS OF TELEMEDICINE 9

Teleradiology, telepathology, telecardiology, teleoncology, teledermatology, telesurgery, e Health and Cyber Medicine.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Norris, A.C. "Essentials of Telemedicine and Telecare", Wiley, 2002
2. H K Huang, ―PACS and Imaging Informatics: Basic Principles and Applications‖ Wiley, New Jersey, 2010.

REFERENCE BOOK(S):

1. Olga Ferrer Roca, Marcelo Sosa Iudicissa, ―Handbook of Telemedicine‖, IOS Press, Netherland, 2002.
2. Khandpur R S, ―Handbook of Biomedical Instrumentation‖, Tata McGraw Hill, New Delhi, 2003.
3. Keith J Dreyer, Amit Mehta, James H Thrall, ―Pacs: A Guide to the Digital Revolution‖, Springer, New York, 2002.
4. Khandpur R S, ―TELEMEDICINE – Technology and Applications‖, PHI Learning Pvt Ltd., New Delhi, 2017.

WEB RESOURCE(S):

- https://www.who.int/goe/publications/goe_telemedicine_2010.pdf

COURSE OUTCOME(S):

CO706-4. 1 To know the origin and evolution of telemedicine and its global and Indian scenarios.

CO706-4. 2 Understand the various communication technologies in telemedicine.

CO706-4. 3 To know the ethical and legal aspects of Telemedicine.

CO706-4. 4 Understand the various techniques involved in data archiving and communication of medical information in telemedicine.

CO706-4. 5 To know the different medical modalities where telemedicine concepts are being applied effectively.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO401	3	3	3	3	2							3
CO402	3	3	3	2	2	1						3
CO403	3	3	3	2	2	3		3				3
CO404	3	3	3	2	2	2	2					3
CO405	3	3	3	1	1	2	3					3

1→Low 2→Medium 3→High

19EC8801 ELECTRONIC MATERIALS L T P C
3 0 0 3

OBJECTIVES:

- Understanding the various materials and its properties contribution towards electrical and electronics field. This course covers the properties of materials behind the electronic applications.

UNIT I INTRODUCTION 9

Structure: atomic structures and bonding, types of bonding, band formation. Defects and imperfections in solids: Point, Line and Planer defects; Interfacial defects and volume defects. Classification of materials based on bonding: conductors, semiconductors and insulators.

UNIT II CONDUCTING MATERIALS 9

Introduction, factors affecting the conductivity of materials, classification based on conductivity of materials, temperature dependence of resistivity, Low resistivity materials (graphite, Al, Cu and steel) and its applications, high resistivity materials (manganin, constantin, nichrome, tungsten) and their applications. Superconductors: Meissner effect, classification and applications.

UNIT III SEMICONDUCTING AND MAGNETIC MATERIALS 9

Semiconductors: Introduction, types of semiconductors, temperature dependence of semiconductors, compound semiconductors, basic ideas of amorphous and organic semiconductors. Magnetic Materials: classification of magnetic materials, ferromagnetism-B-H curve (Qualitative), hard and soft magnetic materials, magneto materials applications.

UNIT IV DIELECTRIC AND INSULATING MATERIALS 9

Dielectric Materials: Introduction, classification, temperature dependence on polarization, properties,dielectric loss, factors influencing dielectric strength and capacitor materials, applications. Insulators: Introduction, thermal and mechanical properties required for insulators, Inorganic materials, organic materials, liquid insulators, gaseous insulators and ageing of insulators, applications.

UNIT V OPTOELECTRONIC ANDNANO ELECTRONIC MATERIALS 9

Optoelectronic materials. Introduction, properties, factor affecting optical properties, role of optoelectronic materials in LEDs, LASERs, photodetectors, solar cells. Nano electronic Materials: Introduction, advantage of nanoelectronic devices, materials, fabrication, challenges in Nano electronic materials. **TOTAL HOURS: 45**

TEXT BOOK(S):

1. S.O. Kasap "Principles of Electronic Materials and Devices", 3rd edition, McGraw-Hill Education (India) Pvt. Ltd., 2007.
2. W D Callister, "Materials Science & Engineering – An Introduction", Jr., John Willey & Sons, Inc, New York, 7th edition, 2007.

REFERENCE BOOK(S):

1. B.G. Streetman and S. Banerjee, Solid State Electronic Devices, 6th edition, PHI Learning, 2009.
2. Eugene A. Irene, Electronic Materials Science, Wiley, 2005
3. Wei Gao, Zhengwei Li, Nigel Sammes, An Introduction to Electronic Materials for Engineers, 2nd Edition, World Scientific Publishing Co. Pvt. Ltd., 2011

WEB RESOURCE(S):

- https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-mm07/

COURSE OUTCOME(S):

CO803-1. 1 With the basis, students will be able to have clear concepts on electronic behaviors of materials

CO803-1. 2 Students will be able to have clear concepts on electronic behaviors of Conducting Materials.

CO803-1. 3 Students will be able to have clear concepts on electronic behaviors of Semiconducting and Magnetic Materials.

CO803-1. 4 Students will be able to have clear concepts on electronic behaviors of Dielectric and Insulating Materials.

CO803-1. 5 Students will be able to have clear concepts on electronic behaviors of Optoelectronic Andnano Electronic Materials.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO101	3	2	2	3								3
CO102	3	3	2	3								3
CO103	3	3	2	3	1							3
CO104	3	3	3	3	1	2						3
CO105	3	3	3	3	2	2					1	3

1→Low 2→Medium 3→High

19EC8802 REAL TIME EMBEDDED SYSTEM L T P C
3 0 0 3

OBJECTIVES:

- Understand the concepts of basic embedded system design
- Be familiar with the embedded computing platform design and analysis.
- Learn the real time operating systems and inter-task communication
- Learn the system design techniques and networks for embedded systems

UNIT I EMBEDDED COMPUTING 9

Challenges of Embedded Systems – Embedded system design process, Embedded processors – 8051 Microcontroller, ARM processor – Architecture, Instruction sets and programming.

UNIT II COMPUTING PLATFORM AND DESIGN ANALYSIS 9

CPU buses – Memory devices – I/O devices – Component interfacing – Design with microprocessors – Development and Debugging – Program design – Model of programs – Assembly and Linking – Basic compilation techniques – Analysis and optimization of execution time, power, energy, program size – Program validation and testing.

UNIT III PROCESSES AND OPERATING SYSTEMS 9

Multiple tasks and processes – Context switching – Scheduling policies – Interprocess communication mechanisms –Evaluating operating system performance – Power optimization strategies for processes.

UNIT IV HARDWARE ACCELERATES & NETWORKS 9

Accelerators – Accelerated system design – Distributed Embedded Architecture – Networks for Embedded Systems – Network based design – Internet enabled systems.

UNIT V EMBEDDED SYSTEM DEVELOPMENT 9

Design issues and techniques – Case studies –Hardware and software co-design - Data Compressor - Software Modem – Personal Digital Assistants – Set–Top–Box. – System-on-Silicon – FOSS Tools for embedded system development.

TOTAL HOURS: 45

TEXT BOOK(S):

1. Marilyn Wolf, ―Computers as Components - Principles of Embedded Computing System Design‖, Third Edition ―Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.

REFERENCE BOOK(S):

1. Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Third Edition Cengage Learning, 2012.
2. David. E. Simon, "An Embedded Software Primer", 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.
3. Raymond J.A. Buhr, Donald L.Bailey, "An Introduction to Real-Time Systems- From Design to Networking with C/C++", Prentice Hall,1999.
4. C.M. Krishna, Kang G. Shin, "Real-Time Systems", International Editions, Mc Graw Hill 1997
5. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dream Tech Press, 2005.
6. Sriram V Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", Tata Mc Graw Hill, 2004.

WEB RESOURCE(S):

1. https://www.geeksforgeeks.org/real-time-systems/
2. https://iitd-plos.github.io/col718/ref/arm-instructionset.pdf
3. https://www.embedded.com/the-basics-of-programming-embedded-processors-part-1/

COURSE OUTCOME(S):

CO803-2. 1 Able to understand the architecture and programming of ARM processor.

CO803-2. 2 Understand the concept of embedded computing platform.

CO803-2. 3 Explain the basic concepts of real time Operating system design.

CO803-2. 4 Learn the different networks used for embedded system.

CO803-2. 5 Model real-time applications using embedded-system concepts

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO201	3	3	3	3	2							3
CO202	3	3	3	2	2	1						3
CO203	3	3	3	2	2	2						3
CO204	3	3	3	2	2	2						3
CO205	3	3	3	1	1	2						3

1→Low 2→Medium 3→High

19EC8803 IMAGE PROCESSING ESSENTIALS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Understand the basics of discrete time signal, system and its response.
- Learn digital image fundamentals.
- Understand the need of Image Transforms.
- Be exposed to simple image enhancement techniques.
- Be familiar with restoration and segmentation techniques.

UNIT I DISCRETE-TIME SIGNAL AND DISCRETE-TIME SYSTEM 9

Introduction to Digital Signal Processing- Sampling and Reconstruction-Standard DT Signals, Concept of Digital Frequency, Representation of DT signal using Standard DT Signals-Signal Manipulations-Classification of Discrete-Time Signals, Classification of Discrete Systems- Concept of Impulse Response and Step Response -Output of DT system using Time Domain Linear Convolution

UNIT II DIGITAL IMAGE FUNDAMENTALS 9

Introduction to Digital Image – Elements of Visual Perception – Fundamental Steps in Digital Image Processing - Need of Sampling and Quantization - Representation of Digital Image - Basic Relationships between Pixels –Colour fundamentals and models File

UNIT III IMAGE TRANSFORMS 9

1D and 2D DFT - 2D-FFT - DCT - Inverse DCT - Discrete Sine – Walsh - Hadamard -Wavelet Transforms - Inverse Wavelet Transforms.

UNIT IV IMAGE ENHANCEMENT 9

Spatial Domain: Basic intensity Transformation Functions – Histogram processing – Spatial filtering smoothing and sharpening - Combining Spatial Enhancement Methods - **Frequency Domain:** Filtering in frequency domain – Smoothing and sharpening filters – Homomorphic Filtering

UNIT V IMAGE RESTORATION AND SEGMENTATION 9

Image restoration: A model of the image degradation/restoration process- noise models- restoration in the presence of noise–only spatial filtering- Weiner filtering- constrained least squares filtering- **Image Segmentation:** Detection of Discontinuities–Edge Linking and Boundary detection – thresholding-Region based segmentation- Morphological processing- erosion and dilation.

TOTAL HOURS: 45

TEXT BOOK:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, ―Signals and Systems‖, Pearson, 2015 (Unit 1)
2. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Fourth Edition, Pearson Education, 2018. (Unit 2, 4,5)
3. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011. (Unit 3)
4. S.Sridhar, "Digital Image Processing" Oxford Publishers, 2011

REFERENCES:

1. B. P. Lathi, ―Principles of Linear Systems and Signals‖, Second Edition, Oxford, 2009.

2. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
3. Willliam K Pratt, "Digital Image Processing", John Willey, 2002.
4. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.

WEB RESOURCE(S):

- http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html
- http://eeweb.poly.edu/~onur/lectures/lectures.html

COURSE OUTCOME(S):

CO803-3. 1 In depth knowledge on the basics of digital signal and system.

CO803-3. 2 Detail idea on digital image fundamentals

CO803-3. 3 Knowledge to use various image transform techniques.

CO803-3. 4 Ability to apply various image enhancement techniques.

CO803-3. 5 Potential to use image restoration and segmentation Techniques.

PO vs CO MAPPING

CO No	PO_a	PO_b	PO_c	PO_d	PO_e	PO_f	PO_g	PO_h	PO_i	PO_j	PO_k	PO_l
CO301	3	3	3	3	2		1					3
CO302	3	3	2	2	2	1						3
CO303	3	2	3	2	2	2						3
CO304	3	3	3	2	2	2	2					3
CO305	3	3	3	1	1	2	3					3

1→Low 2→Medium 3→High

19EC8804 ROBOTIC VISION AND AUTOMATION L T P C
3 0 0 3

OBJECTIVES:

1. To understand the functions of the basic components of a Robot.
2. To study the use of various types of robot drives and End of Effectors.
3. To study the use of various types of Sensors and Machine Vision.
4. To impart knowledge in Robot Kinematics and Programming
5. To learn Robot safety issues and economics.

UNIT I FUNDAMENTALS OF ROBOT 6

Robot - Definition - Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification-Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End

Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION 12

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 13

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 5

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL: 45 PERIODS

TEXT BOOK(S):

1. Klafter R.D., Chmielewski T.A and Negin M., “Robotic Engineering - An Integrated Approach”, Prentice Hall, 2003.
2. Groover M.P., “Industrial Robotics -Technology Programming and Applications”, McGraw Hill, 2001

REFERENCE BOOK(S):

1. Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, 2008.
2. Deb S.R., “Robotics Technology and Flexible Automation” Tata McGraw Hill Book Co., 1994.
3. Koren Y., “Robotics for Engineers", Mc Graw Hill Book Co., 1992.
4. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill Book Co., 1987.
5. Janakiraman P.A., “Robotics and Image Processing”, Tata McGraw Hill, 1995.
6. Rajput R.K., “Robotics and Industrial Automation”, S.Chand and Company, 2008.
7. Surender Kumar, “Industrial Robots and Computer Integrated Manufacturing”, Oxford and IBH Publishing Co. Pvt. Ltd., 1991.

WEB RESOURCE(S):

1. https://nptel.ac.in/content/storage2/courses/112101098/download/lecture-2.pdf
2. https://nptel.ac.in/content/storage2/courses/112101098/download/lecture-21.pdf

3. https://nptel.ac.in/content/storage2/courses/112101098/download/lecture-24.pdf
4. https://nptel.ac.in/content/storage2/courses/112101098/download/lecture-25.pdf
5. https://nptel.ac.in/content/storage2/courses/112101098/download/lecture-26.pdf

COURSE OUTCOME(S):

CO704-3. 1 Understand the anatomy of the robot.

CO704-3. 2 Understand the different types of robot drive systems and end effectors.

CO704-3. 3 Understand the different types of sensors and machine vision.

CO704-3. 4 To design a programming for robotic operation.

CO704-3. 5 Describe the safety, implementation and robot economics.

PO vs CO MAPPING

CO No	**PO_a**	**PO_b**	**PO_c**	**PO_d**	**PO_e**	**PO_f**	**PO_g**	**PO_h**	**PO_i**	**PO_j**	**PO_k**	**PO_l**
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CO302	3	3	3	2	2	1						3
CO303	3	3	3	2	2	2						3
CO304	3	3	3	3	3	3	3					3
CO305	3	3	3	1	1	2	3	1	1	1	1	3

1→Low 2→Medium 3→High