ACADEMIC CURRICULUM & SYLLABUS

(REGULATIONS 2019)

FOR

UNDER GRADUATE PROGRAMMES
CHOICE BASED CREDIT SYSTEM

(Applicable to the students admitted from the Academic Year 2019-20 onwards)

B.E. – ELECTRONICS AND COMMUNICATION ENGINEERING

EASWARI ENGINEERING COLLEGE

(Autonomous Institution)

BharathiSalai, Ramapuram, Chennai - 600 089

[A Unit of SRM Group of Educational Institutions, Approved by AICTE | Affiliated to Anna University, Chennai |NAAC Accredited 'A' Grade | 2(f) & 12(B) Status(UGC) | ISO 9001:2015 Certified | NBA Accredited Programmes | FIST Funded (DST) | SIRO Certified (DSIR)]

CONTENTS

SEMESTER I								
S.No	Course Code	Course Title	Category	L	T	P	R	C
THEORY								
1.	191LEH101T	Technical English	HS	3	0	0	-	3
2.	191MAB101T	Engineering Mathematics I	BS	3	2	0	-	4
3.	191PYB101T	Engineering Physics	BS	3	0	0	-	3
4.	191CYB101T	Engineering Chemistry	BS	3	0	0	-	3
5.	191GES101T	Engineering Graphics	ES	2	0	4	-	4
6.	191GES102T	Problem Solving and Python Programming	ES	3	0	0	-	3
LABORATORY								
7.	191GEB111L	Physics and Chemistry Laboratory	BS	0	0	4	-	2
8.	191GES111L	Python Programming Laboratory	ES	0	0	3	1	2
TOTAL CREDITS								**24**
MANDATORY COURSE								
9.	191GEM101L	Induction Training [&]	MC	-	-	2	-	1[&]

[&] Mandatory to attend Induction training programme and earn one credit.

SEMESTER II								
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**R**	**C**
THEORY								
1.	191LEH201T	Professional Communication / BEC Certification	HS	3	0	0	-	3
2.	191MAB201T	Engineering Mathematics - II	BS	3	2	0	-	4
3.	191PYB201T	Physics for Electronics Engineering	BS	3	-	-	-	3
4.	191GES203T	Basic Civil and Mechanical Engineering	ES	3	-	-	-	3
5.	191ECC201T	Electric Circuits and Electronic Devices	PC	3	2	-	-	4
LABORATORY								
6.	191GES211L	Engineering Practices Laboratory	ES	0	0	4	-	2
7.	191ECC211L	Circuits and Devices Laboratory	PC	-	-	3	1	2
TOTAL CREDITS								**21**
MANDATORY COURSE								
8.	191CYM201T	Environmental Science[&&]	MC	3	-	-	-	3[&&]
9.	191GEM211L	NSS / NCC / YRC – Phase - I[*]	MC	-	-	2	-	1*

[&&] Mandatory to register for the course and earn three credits

[*] The student may opt for any one. They have to complete the respective Phase II and Phase III. Those who are not opting NSS/NCC/YRC have to opt for Foreign language / Indian constitution in the sixth semester.

SEMESTER III								
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**R**	**C**
THEORY								
1.	191MAB303T	Linear Algebra & Partial Differential Equations	BS	3	2	0	0	4
2.	191ECC301T	Electronic Circuits	PC	3	-	-	-	3
3.	191ECC302T	Control System Engineering	PC	3	-	-	-	3
4.	191ECC303T	Signals and Systems	PC	3	2	-	-	4
5.	191ECS301T	Digital Electronics	ES	3	-	-	-	3
LABORATORY								
6.	191ECC311L	Analog Circuits Laboratory	PC	-	-	4	-	2
7.	191ECS312L	Digital Circuits Laboratory	ES	-	-	3	1	2
HUMAN EXCELLENCE COURSE								
8.	191GEH311L	Yoga / Social Service – Phase - I**	HS	-	-	2	-	1
TOTAL CREDITS								**22**
EMPLOYABILITY ENHANCEMENT COURSE								
9.	191ECA311I	Inplant Training / Internship[#]	EEC	-	-	-	-	1[#]
10.	191ECA301I	Industry Supported Course (Optional) [##]	EEC	1	-	-	-	1[##]
ONLINE COURSE								
11.		Online Course (Optional)[$]	PE	-	-	-	-	3[$]

** Student may opt for any one. They have to complete the respective Phase II in semester V.

[#] Mandatory to do Internship and earn minimum one credit between 3rd and 6th semester.

[##] Students may earn credits in lieu of Professional elective - V in 8th semester. Please refer Clause 26.1.1 of B.E. Regulations 2019.

[$] Online courses of three credits each can be considered in lieu of Professional Elective – IV and Professional Elective – VI. A student earned only three credits can drop only Professional Elective – VI. Please refer Clause 14.9 of B.E. Regulations 2019.

SEMESTER IV								
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**R**	**C**
THEORY								
1.	191MAB404T	Probability and Random Process	BS	3	2	-	-	4
2.	191ECC401T	Analog and Integrated Circuits	PC	3	-	-	-	3
3.	191ECC402T	Analog and Digital Communication	PC	3	-	-	-	3
4.	191ECC403T	Engineering Electromagnetics	PC	3	-	-	-	3
5.	191CSS421T	OOPs and Data Structures	ES	3	-	-	-	3
LABORATORY								
6.	191ECC411L	Circuits Design and Simulation Laboratory	PC	-	-	4	-	2
7.	191ECC412L	Communication Systems Laboratory	PC	-	-	3	1	2
8.	191CSS431L	OOPs and Data Structures Laboratory	ES	-	-	4	-	2
EMPLOYABILITY ENHANCEMENT COURSE								
9.	191ECA411L	Technical Seminar	EEC	-	-	2	-	1
TOTAL CREDITS								**23**
MANDATORY COURSE								
10.	191GEM411L	NSS / NCC / YRC – Phase - II*	MC	-	-	2	-	1*
EMPLOYABILITY ENHANCEMENT COURSE								
11.	191ECA411I	Inplant Training / Internship#	EEC	-	-	-	-	1#
12.	191ECA401I	Industry Supported Course (Optional) ##	EEC	1	-	-	-	1##
ONLINE COURSE								
13.		Online Course (Optional) $	PE	-	-	-	-	3$

* Students have to complete the respective phase II.

\# Mandatory to do Internship and earn minimum one credit between 3rd and 6th semester.

\## Students may earn credits in lieu of Professional elective – V in 8th semester. Please refer Clause 26.1.1 of B.E. Regulations 2019.

$ Online courses of three credits each can be considered in lieu of Professional Elective – IV and Professional Elective – VI. A student earned only three credits can drop only Professional Elective – VI. Please refer Clause 14.9 of B.E. Regulations 2019.

SEMESTER V								
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**R**	**C**
THEORY								
1.	191ECC501T	Microprocessors and Microcontrollers	PC	3	-	-	-	3
2.	191ECC502T	Discrete-time Signal Processing	PC	3	2	-	-	4
3.	191ECC503T	Transmission Lines and RF Systems	PC	3	-	-	-	3
4.		Professional Elective I	PE	3	-	-	-	3
5.		Open Elective I	OE	3	-	-	-	3
LABORATORY								
6.	191ECC511L	Microprocessors and Microcontrollers Laboratory	PC	0	-	3	1	2
7.	191ECC512L	Discrete-time Signal Processing Laboratory	PC	0	-	4	-	2
8.	191LEH511L	Interpersonal Skills/ Listening & Speaking	HS	0	-	2	-	1
HUMAN EXCELLENCE COURSE								
9.	191GEH511L	Yoga / Social Service – Phase - II**	HS	-	-	2	-	1
TOTAL CREDITS								**22**
EMPLOYABILITY ENHANCEMENT COURSE								
10.	191ECA511I	In plant Training / Internship[#]	EEC	-	-	-	-	1[#]
11.	191ECA501I	Industry Supported Course (Optional) [##]	EEC	1	-	-	-	1[##]
ONLINE COURSE								
12.		Online Course (Optional) [$]	PE	-	-	-	-	3[$]

** Students have to complete the respective phase II.

[#] Mandatory to do Internship and earn minimum one credit between 3rd and 6th semester.

[##] Students may earn credits in lieu of Professional Elective - V in 8th semester. Please refer Clause 26.1.1 of B.E. Regulations 2019.

[$] Online courses of three credits each can be considered in lieu of Professional Elective – IV and Professional Elective – VI. A student earned only three credits can drop only Professional Elective – VI. Please refer Clause 14.9 of B.E. Regulations 2019.

SEMESTER VI								
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**R**	**C**
THEORY								
1.	191ECC601T	VLSI Design	PC	3	-	-	-	3
2.	191ECC602T	Antennas and Microwave Engineering	PC	3	-	-	-	3
3.	191ECC603T	Internet of Things	PC	3	-	-	-	3
4.		Professional Elective II	PE	3	-	-	-	3
5.		Open Elective II	OE	3	-	-	-	3
LABORATORY								
6.	191ECC611L	VLSI Design Laboratory	PC	-	-	3	1	2
7.	191GEA621T	Soft Skills	HS	-	-	2	-	1
TOTAL CREDITS								**18**
MANDATORY COURSE								
8.	191GEM611L	NSS / NCC / YRC - Phase - III*	MC	-	-	2	-	1*
9.	191GEM601T	Foreign Language / Indian Constitution&	MC	3	-	-	-	3&
EMPLOYABILITY ENHANCEMENT COURSE								
10.	191ECA611I	Inplant Training / Internship#	EEC	-	-	-	-	1#
11.	191ECA601I	Industry Supported Course (Optional) ##	EEC	1	-	-	-	1##
ONLINE COURSE#								
12.		Online Course (Optional) $	PE	-	-	-	-	3$

* Students have to complete the respective phase III.

& Students those who have not earned 3 credits through NSS / NCC / YRC must register for this course and earn 3 credits.

\# Mandatory to do Internship and earn minimum one credit between 3rd and 6th semester.

Students may earn credits in lieu of Professional Elective -V in 8th semester. Please refer Clause 26.1.1 of B.E. Regulations 2019.

$ Online courses of three credits each can be considered in lieu of Professional Elective – IV and Professional Elective – VI. A student earned only three credits can drop only Professional Elective – VI. Please refer Clause 14.9 of B.E. Regulations 2019.

SEMESTER VII								
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**R**	**C**
THEORY								
1.	191ECC701T	Optical Communication and Networks	PC	3	-	-	-	3
2.		Professional Elective – III	PE	3	-	-	-	3
3.		Professional Elective – IV	PE	3	-	-	-	3
4.		Open Elective III	OE	3	-	-	-	3
5.	191ECA701T	Comprehensive Examination[@]	PE	-	-	-	-	3[@]
LABORATORY								
6.	191ECC711L	Advanced Communication Laboratory	PC	-	-	4	-	2
EMPLOYABILITY ENHANCEMENT COURSE								
7.	191ECP711J	Project Work / Start up – Phase - I	EEC	-	-	-	4	2
8.	191ECA711I	Inplant Training / Internship[#]	EEC	-	-	-	-	1
TOTAL CREDITS								**17**
9.	191ECA701I	Industry Supported Course (optional)[# #]	EEC	1	-	-	-	1[##]
ONLINE COURSE[#]								
10.		Online Course (optional) [$]	PE	-	-	-	-	3[$]

[@] Students may earn credits in lieu of Professional elective – III in 7th semester. Please refer clause 26.2 of B.E. Regulations 2019

[#] Mandatory to earn at least one credit by doing internship between 3rd and 6th semester with one credit reflecting in this semester for CGPA calculation.

[##] Students may earn credits in lieu of Professional Elective - V in 8th semester. Please refer Clause 26.1.1 of B.E. Regulations 2019.

[$] Online courses of three credits each can be considered in lieu of Professional Elective – IV and Professional Elective – VI. A student earned only three credits can drop only Professional Elective – VI. Please refer Clause 14.9 of B.E. Regulations 2019.

SEMESTER VIII								
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**R**	**C**
THEORY								
1.		Professional Elective -V	PE	3	-	-	-	3
2.		Professional Elective -VI	PE	3	-	-	-	3
EMPLOYABILITY ENHANCEMENT COURSE								
3.	191ECP811J	Project Work / Start up – Phase - II	EEC	-	-	-	20	10
TOTAL CREDITS								**16**

PROGRAMME TOTAL CREDITS = 163

HUMANITIES & SOCIAL SCIENCE COURSES (HS)

Sl. No.	Subject Code	Subject	Semester	Credits
1.	191LEH101T	Technical English	I	3
2.	191LEH201T	Professional Communication / BEC Certification	II	3
3.	191LEH511L	Interpersonal Skills/ Listening & Speaking	V	1
4.	191GEA621T	Soft Skills	VI	1
5.	191GEH311L	Yoga / Social Service (Phase I)	III	1
6.	191GEH511L	Yoga / Social Service (Phase II)	V	1
TOTAL CREDITS				**10**

BASIC SCIENCE COURSES (BS)

Sl. No.	Subject Code	Subject	Semester	Credits
1.	191MAB101T	Engineering Mathematics I	I	4
2.	191PYB101T	Engineering Physics	I	3
3.	191CYB101T	Engineering Chemistry	I	3
4.	191GEB111L	Physics and Chemistry Laboratory	I	2
5.	191MAB201T	Engineering Mathematics II	II	4
6.	191PYB201T	Physics for Electronics Engineering	II	3
7.	191MAB303T	Linear Algebra & Partial Differential Equations	III	4
8.	191MAB404T	Probability and Random Process	IV	4
TOTAL CREDITS				**27**

ENGINEERING SCIENCE COURSES (ES)

Sl. No.	Subject Code	Subject	Semester	Credits
1.	191GES101T	Engineering Graphics	I	4
2.	191GES102T	Problem Solving and Python Programming	I	3
3.	191GES111L	Python Programming Laboratory	I	2
4.	191GES203T	Basic Civil and Mechanical Engineering	II	3
5.	191GES211L	Engineering Practices Laboratory	II	2
6.	191ECS301T	Digital Electronics	III	3
7.	191ECS312L	Digital Circuits Laboratory	III	2
8.	191CSS421T	OOPs and Data Structures	IV	3
9.	191CSS431L	OOPs and Data Structures Laboratory	IV	2
TOTAL CREDITS				**24**

PROFESSIONAL CORE COURSES (PC)

Sl.No.	Subject Code	Subject	Semester	Credits
1.	191ECC201T	Electric Circuits and Electronic Devices	II	4
2.	191ECC211L	Circuits and Devices Laboratory	II	2
3.	191ECC301T	Electronic Circuits	III	3
4.	191ECC302T	Control System Engineering	III	3
5.	191ECC303T	Signals and Systems	III	4
6.	191ECC311L	Analog Circuits Laboratory	III	2
7.	191ECC401T	Analog and Integrated Circuits	IV	3
8.	191ECC402T	Analog and Digital Communication	IV	3
9.	191ECC403T	Engineering Electromagnetics	IV	3
10.	191ECC411L	Circuits Design and Simulation Laboratory	IV	2
11.	191ECC412L	Communication Systems Laboratory	IV	2
12.	191ECC501T	Microprocessors and Microcontrollers	V	3
13.	191ECC502T	Discrete-time Signal Processing	V	4
14.	191ECC503T	Transmission Lines and RF Systems	V	3
15.	191ECC511L	Microprocessors and Microcontrollers Laboratory	V	2
16.	191ECC512L	Discrete-time Signal Processing Laboratory	V	2
17.	191ECC601T	VLSI Design	VI	3

Sl.No.	Subject Code	Subject	Semester	Credits
18.	191ECC602T	Antennas & Microwave Engineering	VI	3
19.	191ECC603T	Internet of Things	VI	3
20.	191ECC611L	VLSI Design Laboratory	VI	2
21.	191ECC701T	Optical Communication and Networks	VII	3
22.	191ECC711L	Advanced Communication Laboratory	VII	2
TOTAL CREDITS				**61**

PROFESSIONAL ELECTIVE COURSES (PE)

Sl. No.	Subject Code	Subject	Semester	Credits
Professional Elective -I				
1.	191ECE501T	Electromagnetic Interference and Compatibility	V	3
2.	191 ECE502T	Robotics & Automation	V	3
3.	191ECE503T	Machine Learning Techniques	V	3
4.	191ECE504T	Medical Electronics	V	3
5.	191CSE521T	Java Programming	V	3
Professional Elective –II				
6.	191ECE601T	Nano Science and Technology	VI	3
7.	191ECE602T	DSP Architecture and Programming	VI	3
8.	191ECE603T	Digital Image Processing	VI	3
9.	191CSE621T	Computer Architecture & Organization	VI	3
10.	191CSE622T	Artificial Intelligence	VI	3
Professional Elective –III				
11.	191ECE701T	Satellite Communication	VII	3
12.	191ECE702T	Communication Networks	VII	3
13.	191ECE703T	Wireless Communication	VII	3
14.	191ECE704T	Low power VLSI Design	VII	3
15.	191MBE721T	Principles of Management & Psychology	VII	3
Professional Elective -IV				
16.	191ECE711T	Adhoc and Sensor Networks	VII	3
17.	191ECE712T	Advanced Embedded Systems	VII	3

18.	191ECE713T	Photonic Networks	VII	3
19.	191ECE714T	CMOS Analog IC Design	VII	3
20.	191GEE721T	Disaster Management	VII	3
Professional Elective -V				
21.	191ECE801T	Cognitive Radio and 5G Wireless Systems	VII	3
22.	191ECE802T	Analog and Mixed Mode Signal IC Design	VII	3
23.	191ECE803T	Radar and Navigational Aids	VII	3
24.	191ECE804T	Speech Processing and Synthesis	VII	3
25.	191ECE805T	Wireless Networks	VII	3
Professional Elective -VI				
26.	191ITE821T	Mobile Computing	VIII	3
27.	191MBE821T	Total Quality Management	VIII	3
28.	191ECE811T	MEMS and NEMS	VIII	3
29.	191ECE812T	Information Theory and Coding	VIII	3
30.	191ECE813T	Multimedia Compression and Communication	VIII	3
TOTAL CREDITS				**18**

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No.	Subject Code	Subject	Semester	Credits
1.		In plant Training / Internship	III to VII	1
2.	191ECA411L	Technical Seminar	IV	1
3.		Industry Supported Course	V to VII	
4.	191ECP711J	Project Work / Start up – Phase - I	VII	2
5.	191ECP811J	Project Work / Start up – Phase - II	VIII	10

MANDATORY COURSES (MC)

Sl. No.	Subject Code	Subject	Semester	Credits
1.	191GEM101L	Induction Training	I	1
2.	191CYM201T	Environmental Science	II	3
3.	191GEM211L	NSS / NCC / YRC (Phase I)	II	1
4.	191GEM411L	NSS / NCC / YRC (Phase II)	IV	1
5.	191GEM611L	NSS / NCC / YRC (Phase III)	VI	1
6.	191GEM601T	Foreign Language / Indian Constitution	VI	3

CREDIT DISTRIBUTION

SEMESTER ⟶	I	II	III	IV	V	VI	VII	VIII	CREDIT
Humanities and Social Sciences (HS)	3	3	1		2	1			**10**
Basic Sciences(BS)	12	7	4	4					**27**
Engineering Sciences (ES)	9	5	5	5					**24**
Professional Core (PC)		6	12	13	14	11	5		**61**
Professional Electives (PE)					3	3	6	6	**18**
Open Electives (OE)					3	3	3		**9**
Employability Enhancement Courses (EEC)				1			3	10	**14**
Total Credit	**24**	**21**	**22**	**23**	**22**	**18**	**17**	**16**	**163**

NON CGPA COURSES DETAILS

	I	II	III	IV	V	VI	VII	VIII	Minimum credits to be earned for awarding degree
In plant Training / Internship			√	√	√	√	√		**1**
Industry Supported Course			√	√	√	√	√		**-**
Mandatory courses (MC)	√	√		√		√			**7**
Online Courses (PE)			√	√	√	√	√		**-**

SYLLABUS

(REGULATIONS 2019)

FOR

UNDER GRADUATE PROGRAMMES
CHOICE BASED CREDIT SYSTEM

(Applicable to the students admitted from the Academic Year 2019-20 onwards)

B.E. – ELECTRONICS AND COMMUNICATION ENGINEERING

EASWARI ENGINEERING COLLEGE
(AUTONOMOUS INSTITUTION)
Bharathi Salai, Ramapuram, Chennai – 600 089

191LEH101T	TECHNICAL ENGLISH	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To develop the basic writing skills of the First year Engineering students.
- To help learners develop their listening skills, which will, enable them to listen to lectures and enhance their ability to comprehend by asking questions and seeking clarification.
- To help learners develop their speaking skills and help them to speak fluently.
- To inculcate reading habit and to develop effective reading skills.
- To help students improve their active and passive vocabulary.

UNIT I **9**

Short comprehension passages – skimming, scanning, predicting and inference of the passage – Tips for effectivewriting–Hints development – Purpose of a good conversation – Tips for improving Conversation – Active and Passive listening – Types of listening – Barriers to listening – listening for specific purposes – Listening to lectures and note taking - Parts of Speech - Tenses – WH Questions – Yes/No questions – Prefixes and Suffixes – Word formation.

UNIT II

Longer Comprehension passages - Questions – multiple choice – short questions – open-ended questions – Sentence structure - Types of paragraph – Short narrative paragraphs– Comparison and contrast – argumentative paragraph – analytical paragraph – Techniques for writing precisely - Introducing your friend – Exchange information – Expressing opinion/ agreeing /disagreeing **-** Telephonic conversation - If Clause – Subject verb agreement – degrees of comparison – Pronouns - adverbs.

UNIT III **9**

Short texts – Cloze passage guessing from context – Note making – Use of reference words – Discourse markers – Connectives – Jumbled sentences –Product description–Process description - Prepositions - Direct/Indirect speech – Connotations – One word substitution – Idiomatic expressions.

UNIT IV **9**

Different types of texts – Newspapers/ magazines/short stories - Inference – Tips for effective writing – Letter writing –– Letter to the Editor - Speaking about oneself/ hometown – Review of books – listening to native speakers – American accent and neutral accent - Countable/Uncountable nouns – Articles – Synonyms and Antonyms – Phrasal verbs.

UNIT V **9**

Reading for specific purpose – Short essays – developing an outline – Group discussion – Giving advice – Modal verbs – Instructions and Recommendations - Collocations.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Listen, Understand and Respond to others in different situations.
2. Speak correctly and fluently in different situations using appropriate communication strategies.
3. Read and Comprehend a range of texts adopting different reading skills.
4. Write with clarity in simple, apt and flawless language with coherence and cohesion.
5. Use their communicative competency with purpose and clarity in the context of Science and Technology.

TEXT BOOKS:

1. Sanjay Kumar, Pushp Lata. English Language and Communication Skills for Engineers, Oxford University Press 2018.

REFERENCE BOOKS:

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011.
2. Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books:2013
3. Means,L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning USA:2007

E-BOOKS / WEB REFERENCES:

1. https://www.usingenglish.com
2. http://grammarbook.com

JOURNALS:

1. National Council for Teachers of English https://www2.ncte.org/resources/journals/college-english

EXTENSIVE READER :

1. Spencer Johnson, Who Moved My Cheese, Putnam Adult, 1998

191MAB101T ENGINEERING MATHEMATICS - I

L	T	P	R	C
3	2	0	0	4

PREREQUISITES: NIL

UNIT I : MATRICES **12**

Overview of system of Linear Equations - Eigen values and Eigen vectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigen vectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II : DIFFERENTIAL CALCULUS **12**

Limit of a function - Continuity - Derivatives – Differentiation Rules – Mean Value Theorem – Interval of increasing and decreasing functions – Maxima and Minima - Interval of concavity and convexity –

Taylor's Series for one variable.

UNIT II : MULTIVARIABLE CALCULUS **12**

Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties–Taylor's series for functions of two variables – Maxima, minima and saddle points - Method of Lagrange multipliers.

UNIT III : INTEGRAL CALCULUS **12**

Definite Integrals and its properties –Fundamental theorem of Calculus - Techniques of integration for Indefinite Integrals using basic integration formulas – Integration by parts – Trigonometric Substitutions – Integration of Rational functions by Partial Fractions.

UNIT IV : MULTIPLE INTEGRATION **12**

Double integrals – Change the order of integration in double integrals - Change of variables (Cartesian to polar) - Applications: areas and volumes - Triple integrals (Cartesian, Cylindrical and Spherical coordinates).

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. To express large amounts of data and functions in an organized and concise form apart from diagonalizing matrices.
2. To solve maxima and minima problems using differentiation.
3. Apply functions of several variables to solve problems in engineering and technology.
4. To evaluate integrals by using Fundamental Theorem of Calculus.
5. Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change the order and change of variables.

TEXT BOOKS:

1. Grewal B.S., - Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed.,2014.

2. Joel Hass, Christopher Heil and Maurice D.Weir “Thomas’ Calculus”, 14th Edition,Pearson.

REFERENCE BOOKS:

1. Bali N.P. and Manish Goyal, “Engineering Mathematics” (For Semester I) Third Edition, University Science Press.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley &Sons.
3. Fritz John and Richard Courant, “Introduction to Calculus and Analysis”Springer.
4. James Stewart, "Calculus: Early Transcendental", Cengage Learning, 7th Edition, New Delhi,2015.
5. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, NewDelhi

191PYB101T	ENGINEERING PHYSICS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I : PROPERTIES OF MATTER **9**

Stress - Strain relationship, Hooke’s law, Elastic moduli, Stress - Strain diagram for various engineering materials, Ductile and Brittle materials - Torsional pendulum – Beam, Expression for bending moment - Cantilever, Uniform and Non- uniform bending, Theory and Experimental determination of Young’s modulus.

UNIT II : SOUND WAVES AND VIBRATIONS **9**

Propagation, Intensity, Loudness of sound waves – Determination of absorption coefficient, Reverberation, Sabine’s formula for reverberation time - Factors affecting acoustics of buildings and their remedies - Acoustic Quieting: Aspects, Methods, Quieting for Specific observers, Mufflers, Soundproofing - Ultrasonic waves and properties,

Methods of Ultrasonic production, Applications of Ultrasonic in engineering and medicine.

UNIT III : THERMAL PHYSICS 9

Fundamentals of thermal energy – Expansion joints - Bimetallic strips - Thermal conductivity, conductions in solids, Differential equation of one dimensional heat flow- Forbe‘s and Lee‘s disc method - Conduction through compound media –Thermal insulation – thermal shock resistance - Applications: Solar water heater- tempered glass-cryogenicmaterials.

UNIT IV : QUANTUM MECHANICS 9

Inadequacies of Classical Mechanics – Black body radiation- Planck’s theory of radiation - Dual nature of electromagnetic radiation – De Broglie hypothesis for matter waves – Heisenberg’s uncertainty principle – Schrodinger’s time dependent and independent wave equation, significance of wave function - Born interpretation - Particle confinement in 1D box.

UNIT V : APPLIED OPTICS 9

Spontaneous and Stimulated emission - Einstein co-efficients (derivation) – Spatial and Temporal coherence – Schawlow- Townes condition for population inversion (Qualitative study) - Types of lasers – Nd:YAG, Semiconductor - Applications of Laser in science, engineering and medicine.

Principle and propagation of light in optical fibre, Derivation for Numerical aperture and Acceptance angle - Types and losses of optical fibre - Fibre Optical Communication (Block diagram) - Active and Passive sensors - Medical endoscope.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. The students will gain knowledge on the basics of properties of matter and its applications.
2. The students will acquire knowledge on the concepts of sound waves and vibrations.

3. The students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and solar water heaters
4. The students will get knowledge on advanced physics concepts of quantum theory.
5. The students will acquire knowledge on the concepts of optical devices and their applications in fibre optics.

TEXT BOOKS:

1. Bhattacharya D.K & T.Poonam, Engineering Physics ,Oxford University Press,2015.
2. Pandey B.K.& S.Chaturvedi, Engineering Physics, Cengage Learning India,2012.
3. Senthilkumar, G. Engineering Physics I, VRB Publishers,2011.

REFERENCE BOOKS:

1. Aruldhas G, Quantum Mechanics, PHI Learning Pvt. Ltd.,New Delhi,2011.
2. Arthur Beiser,Concepts of Modern Physics, 6thedn.,McGraw Hill2003.
3. Gaur R.K &S.L.Gupta, Engineering Physics, DhanpatRai Publishers,2012.
4. Halliday D, R.Resnick&J.Walker, Principles of Physics, Wiley,2015.
5. Serway R.A &J.W.Jewett, Physics for Scientists and Engineers, Cengage Learning,2010.
6. Tipler P.A &G.Mosca, Physics for Scientists and Engineers with Modern Physics, W.H.Freeman, 2007.
7. Zeemansky M.W and R.H.Dittman, Heat and Thermodynamics, 8thedn., Mc.Graw Hill, NewYork, 2017

191CYB101T	ENGINEERING CHEMISTRY	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To get the basic idea about the polymers and applications of polymers and polymer reinforced composites.
- It deals with the information about the types of fuels, calorific value calculations and manufacture of solid,liquid and gaseous fuels.
- It enable the students to gain information about Principles and generation of energy in batteries, nuclearreactors, solar cells, wind mills and fuel cells.
- To impart knowledge about the nanomaterials synthesis, properties and applications

UNIT I : WATER TREATMENT AND TECHNOLOGY 9

Introduction – characteristics - alkalinity - types and determination – hardness – types only -boiler feed water- requirements-boiler troubles – scale & sludge -disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) - softening of hard water - external treatment process - demineralization and zeolite, internal treatment - boiler compounds (phosphate, calgon, carbonate and colloidal conditioning methods) – desalination of brackish water –reverse osmosis

UNIT II : POLYMERS AND REINFORCED PLASTICS 9

Introduction- classification of polymers - Natural and synthetic - Thermoplastic and Thermosetting, Functionality–Degree of polymerization,types - addition and condensation polymerization – free radical polymerization mechanism - Preparation, properties and uses of PVC, Nylon 6,6, Teflon and Epoxy resin. Plastics - Compounding of plastics – moulding methods –injection, extrusion and compression – FRP – carbon and glass –applications.

UNIT III : FUELS AND COMBUSTION 9

Classification - Coal – proximate and ultimate analysis, - carbonization -metallurgical coke –manufacture by Otto Hoffmann method – petroleum – refining - cracking –synthetic petrol by Bergius process - knocking in petrol and diesel engines- octane and cetanerating of fuels-synthesis – advantages and commercial application of power alcohol and biodiesel- Gaseous fuels- liquefied petroleum gases (LPG)- compressed natural gas (CNG)- Combustion of fuels: Introduction - calorific value–higher & Lower– theoretical calculation - Flue gas analysis by Orsatmethod.

UNIT IV : ENERGY SOURCES AND STORAGE DEVICES 9

Energy – Types – Non-renewable energy - Nuclear energy –fission and fusion reactions - differences between nuclear fissionand fusion - nuclear chain reactions - light water nuclear reactor for power generation – breeder reactor – renewable energy - solar energy conversion - solar cells – wind energy.

Electrochemical cells – reversible and irreversible cells –Cell construction and representation - Batteries -types of batteries – characteristics – construction and working of primary battery (dry cell) - secondary battery (lead acid battery and lithium-ion-battery) - fuel cells(H_2-O_2)

UNIT V : CONCEPTS OF NANO CHEMISTRY AND GREEN CHEMISTRY 9

Nano chemistry introduction – basics –general properties - distinction between nanoparticles, molecules and bulk materials–size-dependent properties. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electro deposition, chemical vapour deposition, laser ablation - properties of nanoparticles – Types of Nanoparticles:nano cluster, nano rod, nanowire and nano tube – Carbon Nano Tube (Synthesis, properties and applications) – applications of nanoparticles.

Green chemistry introduction - Principles -Applications

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. The knowledge gained on water treatment techniques will facilitate better understanding of engineering processes and applications for furtherlearning
2. The knowledge gained on water treatment techniques will facilitate better understanding of engineering processes and applications for furtherlearning.
3. Students can get knowledge about various fuels and its applications based on its calorificvalue.
4. It provides the students to understand about conventional and non-conventional energy sources and its applications
5. It provides the students to gain knowledge about the recent trends in nanomaterials

TEXT BOOKS:

1. Kannan P and Ravikrishnan A, “Engineering Chemistry”, Sri Krishna, Hitech publishing Company Pvt Ltd, 2014
2. Jain P.C. and Monika Jain, “Engineering Chemistry” Dhanpat Rai, Publishing Company(P) Ltd.,New Delhi, 2015.

REFERENCE BOOKS:

1. Dara S.S &S.S Umare, “A Text book of Engineering Chemistry”, S.Chand & Company Ltd., New Delhi,2015.
2. Palanna O.G, “Engineering Chemistry”, McGraw Hill Education (India)Pvt. Ltd,Chennai,2017
3. VairamS ,P. Kalyani and Suba Ramesh., “Engineering Chemistry”, Wiley India PVT, Ltd, New Delhi, 2013.

191GES101T	ENGINEERING GRAPHICS	L	T	P	R	C
		2	0	4	0	4

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To develop students, graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing National standards related to technical ldrawings.
- To Familiarize with basic geometrical constructions and orthographic projections.
- To make the students to draw the different projections of the solids.
- To view the true shape and apparent shape of the sectioned solids and their developments.
- To get an idea about 3D views through isometric projections.

UNIT 0 : CONCEPTS AND CONVENTIONS USED 2

Principles of Engineering graphics and their significance - Use Of drawing Instruments-BIS conventions and specifications-Size, Layout and folding of drawing sheets-Lettering and Dimensioning.

UNIT I : PLANE CURVES, PROJECTIONOF POINTS 17

Conic Sections - Construction of Ellipse, Parabola & hyperbola by eccentricity method – Construction of cycloid – Introduction to Scales. Introduction of Orthographic projection - Principal planes - First angle projection - projection of points.

UNIT II : PROJECTION OF LINES AND PLANES 17

Projection of straight lines inclined to both the principal planes by rotating line method. Projection of simple planes inclined to both the principal planes by rotating object method.

UNIT III : PROJECTION OF SOLIDS 17

Projection of simple solids like Prism, Pyramid, Cylinder& Cone when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV : SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 17

Sectioning of simple solids (Prism, Pyramid, Cylinder& Cone) in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of surfaces of right regular and sectioned solids

UNIT V : ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS 17

Principles of Isometric projections-Isometric scale- Isometric Views of simple and truncated solids – combination of two solid objects in simple vertical positions. Conversion of Isometric views to Orthographic views of the objects.

UNIT VI : COMPUTER AIDED DRAFTING :

(Demonstration Only, Not for Exam) **3**

The Concepts of Computer Aided Drafting for Engineering drawing, Computer graphics & Geometrical modeling (2D Orthographic Views) and 3D drafting (Isometric Views) using AutoCAD.

TOTAL PERIODS: 90 HOURS

COURSE OUTCOMES:

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

1. Familiarize with the fundamentals and standards of Engineering graphics
2. Perform basic geometrical constructions and principles of orthographic projections.
3. Project orthographic projections of lines and planesurfaces.
4. Draw projections of solids and development ofsurfaces.
5. Visualize and to project isometric views and conversion of Isometric views to Orthographic views.
6. Understand the basics of AUTO CAD and fundamentals of perspective projections.

TEXT BOOKS:

1. Natarajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai,2009.

2. Jayapoovan T, “Engineering Graphics using AUTOCAD”, Vikas Publishing ,7thEdition.
3. Venugopal K. and Prabhu Raja V., “Engineering Drawing with AUTOCAD and building drawing”, New Age International (P) Limited, 2018, 5TH edition.

REFERENCE BOOKS:

1. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition,2010.
3. Dinesh Kumar S, K.Sivakumar and R.Ramadoss, “Engineering Graphics”, Maruthi Publishers, Chennai, 2019.
4. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore,2007.
5. Parthasarathy N S and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi,2015.
6. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition,2009.

191GES102T	PROBLEM SOLVING THROUGH PYTHON PROGRAMMING	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- The course on Python Programming is intended to enhance the computational and logical thinking of students.
- Upon completion of the course, the students would be able to master the principles of Python programming and demonstrate significant experience in problem solving.

UNIT I : ALGORITHMIC PROBLEM SOLVING **9**

Algorithms, building blocks of algorithms (statements, control flow, functions), notation (pseudo code, flow chart, programming language),

algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Case study: Towers of Hanoi, insertion sort, guess an integer number in a range.

UNIT II : CONTROL FLOW STATEMENTS 9

Python interpreter, interactive mode and script mode; variables, expressions, statements; values and data types; Operators and Precedence of operators, comments; Conditionals: conditional, alternative, chained conditional, nested conditional; Iterations: while, for, break, continue.

UNIT III : FUNCTIONS AND STRINGS 9

Modules and functions: function definition and use, flow of execution, parameters and arguments; Fruitful functions: return values, composition, recursion; Strings: string slices, immutability, Looping and counting, String methods.

UNIT IV : LIST, TUPLE AND DICTIONARIES 9

Lists: list operations, list slices, list methods, traversing, mutability, aliasing, list arguments, list comprehension; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and functions, Looping and dictionaries, histogram.

UNIT V: FILES, EXCEPTIONS 9

Files: text files, reading and writing files, format operator, filenames and paths; Exceptions: handling exceptions, multiple exception blocks, finally block; Case study: tkinter.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Design solutions to simple computationalproblems
2. Read, write and execute Pythonprograms.
3. Decompose a Python program intofunctions
4. Implement compound data using Python lists, tuples, anddictionaries.
5. Read and write data from/to files in PythonPrograms.
6. Understand the GUI concepts and implement inPython.

TEXT BOOKS:

1. Allen B.Downey,``Think Python: How to Think Like a Computer Scientist‘‘, Version 2.0 .17 edition, Updated for Python 3, Shroff/O‘Reilly Publishers, http://greenteapress.com/wp/thinkpython/)
2. Reema Thareja “Python Programming using Problem solving Approach”, Oxford University Press.

REFERENCE BOOKS:

1. Paul Gries, Jennifer Campbell and Jason Montojo , ”Practical Programming :An Introduction to Computer Science using Python 3”, Second edition, Pragmatic Programmers, LLC,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.

		L	T	P	R	C
191GEB111L	**PHYSICS AND CHEMISTRY LABORATORY**	**0**	**0**	**4**	**0**	**2**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To gain knowledge in the scientific methods and learn the process of measuring different Physical variables
- Develop the skills in arranging and handling different measuring instruments
- Get familiar on experimental errors in various physical measurements and to plan/ suggest on how the contributions could be made of the same order, so as to minimize the errors.

LIST OF EXPERIMENTS

(A) PHYSICS LABORATORY

ANY FIVE EXPERIMENTS

1. Torsion Pendulum – Rigidity modulus of wire and moment of inertia of disc.
2. Non Uniform Bending – Young's modulus determination.
3. Spectrometer – Wave length of spectral lines using grating.
4. Lee's Disc – Thermal Conductivity of bad conductor.
5. Semiconductor Laser –Wavelength of laser light, Size of particle and Numerical aperture of optical fiber.
6. Air Wedge – Measurement of thickness of thin wire.
7. Determination of the Band gap of a semiconductor.
8. Ultrasonic Interferometer - Velocity of sound and Compressibility of liquid.

TOTAL PERIODS: 30 HOURS

TEXT BOOKS:

1. G.Rajkumar, Physics laboratory Practical, McGraw Hill publication,2019.
2. R.K.Shukla and Anchal Srivastava, Practical Physics, 1st Edition, New Age International (P) Ltd, NewDelhi, 2006.
3. Physics Laboratory Manual, Faculty Members, Department of Physics, Easwari Engineering College,Chennai.

REFERENCE BOOKS:

1. Chattopadhyay D, P.C.Rakshit and B.Saha, An Advanced Course in Practical Physics, 2nd ed., Books & Allied Ltd., Calcutta,1990.
2. Souires G L , Practical Physics, 4th Edition, Cambridge University, UK,2001.

(B) CHEMISTRY LABORATORY

COURSE OBJECTIVES:

- To gain knowledge in the scientific methods and learn the process of measuring different Physical variables

- Develop the skills in arranging and handling different measuring instruments
- Get familiar on experimental errors in various physical measurements and to plan/ suggest on how the contributions could be made of the same order, so as to minimize the errors.

LIST OF EXPERIMENTS

(B) CHEMISTRY LABORATORY

ANY FIVE EXPERIMENTS

1. Determination of chloride content of water sample by Argentometric method
2. Determination of strength of given HCl using pH meter
3. Determination of strength of acid in a mixture using conductivity meter.
4. Determination of permanent, total and temporary hardness of water sample.
5. Estimation of Fe^{2+} by Potentiometrictitration
6. Determination of molecular weight of PVA using Ostwald viscometer
7. Determination of alkalinity in water sample
8. Estimation of Iron content in water sample using spectrophotometer (1,10 – Phenanthroline / thiocyanate method)
9. Conductometric titrations of strong acid Vs strong base
10. Determination of DO Content of water sample by Wrinkles method
11. Determination of BOD and COD in water sample

TOTAL PERIODS: 30 HOURS

COURSE OUTCOMES:

1. Upon completion of this course, student will be able to:
2. The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

REFERENCES:

1. Dr. C. Ravichandran, “Engineering Chemistry Laboratory-I” Global publications,2019.
2. FurnissB.S.HannafordA.J,SmithP.W.GandTatchelA.R.,“Vogel’s Textbookofpracticalorganicchemistry, LBS Singapore(1994).
3. JefferyG.H,BassettJ.,MendhamJ.andDennyR.C.,“Vogel’sTextb ookofquantitativeanalysischemical analysis”, ELBS 5th Edn. Longman, Singapore publishers, Singapore,1996.
4. Daniel R. Palleros, “Experimental organic chemistry” John Wiley & Sons, Inc.,New York (2001).

191GES111L	**PYTHON PROGRAMMING LABORATORY**	**L**	**T**	**P**	**R**	**C**
		0	**0**	**3**	**1**	**2**

PREREQUISITES: NIL

COURSE OBJECTIVES:

The course on Python programming laboratory is used to write, test and debug simple Python programs. Upon completion of the course, the students would be able to master the concepts of data types, loops, functions, list, tuples, dictionary, files and GUI.

LIST OF EXPERIMENTS

1. LCM of two numbers
2. Sum of squares of first n natural numbers
3. Fibonacci series.
4. Armstrong number
5. Sum of Digits in a Number.
6. First n prime number.
7. Factorial of a number using recursion
8. Count the number of vowels in a string
9. Matrix multiplication
10. Simple calculator
11. Linear search
12. Selection sort
13. Insertion sort

14. Word count.
    - Mini Project (any ONE): Design GUIfor
    - Airline reservationsystem
    - Feedbacksystem
    - Employee managementsystem
    - Student managementsystem
    - Banking Sytstem

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Write, test, and debug simple Python programs.
2. Implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using Python lists, tuples, dictionaries.
5. Read and write data from/to files in Python
6. Design GUI applications

191LEH201T	PROFESSIONAL COMMUNICATION	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To strengthen their listening skills which help them comprehend lectures and talks in their areas of specialization
- To develop their speaking skills to make technical presentations, participate in Group Discussions.
- To develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- To foster their ability to write convincing job applications
- To equip with appropriate skills for writing effective reports.

UNIT I : 9

Communication – Process of Communication – Different forms of

communication – Communication flow- Barriers of communication - Purpose and Function expressions – Extended definitions – Cause and Effect expressions - Compound nouns- Homonyms/homophones

UNIT II : 9

Listening to technical talks - Body language pertaining to Presentation– countering stage fright – Preparing PPT for presentation – Interpreting charts/graphs/pie charts/ bar diagram/tabular column/ tree diagram – Words often confused – Active/ Passive/ Impersonal Passive Voice – Numerical adjectives.

UNIT III : 9

Etiquette of Group discussion – discussing GD topics - reading journals and paraphrasing – Report Writing – Accident report/– Industrial visit report – Words often Misspelt – Describing a process using sequence words – Words used as different parts of speech

UNIT IV : 9

Small talk – review on films and books – email etiquette - Cover letter & Resume – Calling for quotations – Placing order – Letter of complaint - escalation letter - Feasibility report - Project report – - Abbreviations and Acronyms pertaining to Science and Technology – Types of Essays - Argumentative, Analytical, Descriptive & Expository.

UNIT V : 9

Writing Statements of Purpose-format, Sample – Modifiers, Redundancies-Direct indirect speech-Project Proposal – Minutes of Meeting - Verbal Analogies – Case studies relating to Goal Setting-Writing articles.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Learners can draft effective formal letters and emails.
2. Listen and comprehend different technical/ non-technical excerpts critically and infer the implied meaning.

3. Write ungrammatically and help in organizing ideas logically on a topic using a wide range of vocabulary
4. Read different genres of texts and evaluate them for content and structure.
5. Be proactive in using the language confidently and effectively for personal and professional growth.

TEXT BOOKS:

1. Raymond Murphy, English Grammar in Use: Reference and Practice for Intermediate Students, Cambridge : CUP, 2004

REFERENCE BOOKS:

1. M. Ashraf Rizvi 'Effective Technical Communication', Tata McGraw-Hill, New Delhi,2005
2. Richard Johnson - Sheehan, Technical Communication Today, Longman Publishing Group,2011
3. Golding S.R. 'Common Errors in English Language', Macmillan,1978

E-BOOKS / WEB REFERENCES:

1. https://owl.purdue.edu
2. https:www.hellolingo.com

JOURNALS:

1. IEEE/transactions on Professional Communication
2. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=47

EXTENSIVE READER :

1. Stephen R. Covey, The Seven Habits of Highly Effective People, Free Press, 1989

191MAB201T ENGINEERING MATHEMATICS - II

L	T	P	R	C
3	2	0	0	4

Common to all Branches of Engineering and Technology

PREREQUISITES: NIL

COURSE OBJECTIVES:

- The objective of this course is to familiarize the prospective engineers with techniques inordinary differential equations, complex variables and complex integration.
- The Study of Laplace transform help to solve the differential equations that occur in various branches of engineering disciplines.
- Vector calculus can be widely used for modelling the various laws of physics.
- The various methods of complex analysis can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I : ORDINARY DIFFERENTIAL EQUATIONS 12

Basic concepts - Separable differential equations - Exact differential equations - Integrating factors - Linear differential equations – Second order linear differential equations with constant coefficients – Particular Integral using operator method and Method of variation of parameters – Homogenous equation of Euler‘s and Legendre‘stype.

UNIT II : LAPLACE TRANSFORMS 12

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Transform of periodic functions - Inverse transforms: Convolution theorem (Statement only) and Partial Fractions - Application to solution of linear second order ordinary differential equations with constant coefficients.

UNIT III : VECTOR CALCULUS 12

Gradient and directional derivative – Divergence and curl – Irrotational and Solenoidal vector fields – Line integral – Surface integral - Area of

a curved surface - Green's, Gauss divergence and Stokes' theorems in evaluating line, surface and volume integrals (Planar, Cylindrical and SphericalSurfaces)

UNIT IV : COMPLEX VARIABLES **12**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian form - Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping – Mapping by function

$w = z + c,\ cz,\ \frac{1}{z},\ z^2$ - Bilinear transformation.

UNIT V : COMPLEX INTEGRATION **12**

Complex integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's Series – Singularities– Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour (No poles on the real axis).

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. The effective mathematical tools to obtain the solutions of first and second order differential equations that model physical processes.
2. Gradient, divergence and curl of a vector point function and related identities. Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.
4. Analytic functions, conformal mapping and complex integration.
5. Laplace transform and inverse transform of simple functions, properties, various related theorems and application to solve the differential equations with constant coefficients.

TEXT BOOKS:

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43rd Edition,2014.
2. Joel Hass, Christopher Heil and Maurice D.Weir Thomas’ Calculus, 14th Edition,Pearson.

REFERENCE BOOKS:

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, 9th Edition, John Wiley &Sons.
2. N.P.Bali and Manish Goyal “ Engineering Mathematics”(For Semester II) Third Edition, UniversityScience Press
3. Veerarajan T., “Engineering Mathematics for first year”, Tata McGraw-Hill, New Delhi.
4. O’Neil,P.V., “Advanced Engineering Mathematics”, Cengage Learning India Pvt., Ltd, NewDelhi, 2007.
5. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.

191PYB201T	**PHYSICS FOR ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**R**	**C**
		3	**0**	**0**	**0**	**3**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To enrich the understanding of various types of materials and their applications in electronics, communication, electrical and instrumentation engineering

UNIT I : CONDUCTING MATERIALS **9**

Conductors – classical free electron theory of metals – Expression for electrical and thermal conductivity – Wiedemann- Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II : SEMICONDUCTING MATERIALS 9

Direct and indirect semiconductors - Intrinsic Semiconductors – Carriers concentration in intrinsic semiconductors (derivation) – extrinsic semiconductors (Qualitative study) - variation of Fermi level with temperature and impurity concentration in n and p type semiconductors – Carrier transport: Velocity-electric field relations – drift and diffusion transport – Hall effect and devices – Zener and avalanche breakdown in p-n junctions - Ohmic contacts – tunnel diode - Schottky diode – MOS capacitor - Power transistor.

UNIT III : MAGNETIC AND SUPER CONDUCTING MATERIALS 9

Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility – types of magnetic materials – Ferromagnetism: origin and exchange interaction - saturation magnetization and Curie temperature - Domain theory - Hysteresis based on domain theory-Hard and soft magnetic materials–Applications: Transducer-Hard disc-Magneto opticalrecording.

Superconductivity: Properties – Type I and Type II superconductors – BCS theory of superconductivity (Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, Cryotron, Magnetic levitation.

UNIT IV : DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant –Types of polarization (Quantitative) – Frequency and temperature dependence of polarisation – Internal field – Claussius–Mosotti equation – dielectric loss - dielectric breakdown - Uses of dielectric materials in Capacitor and Transformer– Ferroelectricity and applications.

UNIT V : ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): characteristics, properties and applications of Ni:Ti alloy – Nanomaterials - Quantum size effect - Quantum dot, Wire and Well - Carbon nanotube and its types, Potential uses of nanomaterials in electronics, robotics, computers, sensors, mobile

electronic devices – NLO materials – Birefringence - optical Kerr effect – Classification of Biomaterials and its applications.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Gain knowledge on classical and quantum electron theories, and energy band structures.
2. Acquire knowledge on basics of semiconductor physics and its applications in various devices
3. Get knowledge on magnetic and dielectric properties of materials
4. Have the necessary understanding on the functioning of advanced materials

TEXT BOOKS:

1. P.K.Palanisamy, Materials Science, SCITECH Publishers,2011.
2. S.O.Pillai, Solid State Physics, New Age International(P) Ltd., publishers,2009.
3. V.Rajendran, Materials Science, Mc Graw Hill Education (India) Private Ltd.,2017.

REFERENCE BOOKS:

1. S.O.Kasap, Principles of Electronic Materials and Devices, McGraw- Education, 2007.
2. Umesh K Mishra and JaspritSingh,Semiconductor Device Physics and Design, Springer,2008.
3. M.A.Wahab, Solid State Physics: Structure and Properties of Materials, Narosa Publishing House,2009.
4. Arthur Beiser,Concepts of Modern Physics, 6thedn.,McGraw Hill2003.
5. T.Pradeep, Nano: The Essentials, Mc Graw Hill Publishing Co. Ltd.,2007.
6. Charles P. Poole Jr., Frank J. Owens, Introduction to nano technology, Wiley,2003.

191GES203T	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To impart basic knowledge on Civil and Mechanical Engineering.
- To familiarize the materials used in Civil Engineering.
- To provide the exposure on the fundamental elements of civil engineering structures.
- To enable the students to distinguish the components and working principle of power plant units and IC engines.
- To provide the basic knowledge on working of Refrigeration and Air conditioning systems.

UNIT I : SCOPE OF CIVIL AND MECHANICAL ENGINEERING **9**

Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering.

Overview of Mechanical Engineering - Mechanical Engineering contributions to the welfare of Society –Specialized sub disciplines in Mechanical Engineering - Production, Automobile, Energy Engineering. Interdisciplinary concepts in Civil and Mechanical Engineering.

UNIT II : SURVEYING AND CIVIL ENGINEERING MATERIALS **9**

Surveying: Objects – classification – principles – measurements of distances –Application of surveying using GPS – Principles of remote sensing and GIS.

UNIT III : BUILDING COMPONENTS **9**

Components of building – Substructure and Superstructure – Foundation - Brick masonry –– beams -columns – roofing -flooring –

plastering – floor area, carpet area and floor space index - water supply - sources and quality of water - Rain water harvesting

UNIT IV : INTERNAL COMBUSTION ENGINES AND POWER PLANTS 9

Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants –- working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps.

UNIT V : REFRIGERATION AND AIRCONDITIONING SYSTEM 9

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Appreciate the Civil and Mechanical Engineering components of Projects.
2. Explain the usage and proper selection of construction materials and usage of modern surveying instruments.
3. Identify the components used in power plant cycle.
4. Demonstrate working principles of petrol and diesel engine.
5. Elaborate the components of refrigeration and Air conditioning cycle.

TEXT BOOKS:

1. Shanmugam G and Palanichamy MS, “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co.,New Delhi, 1996.
2. Anji Reddy M, “Text book of Remote sensing and Geographical Systems”, BS Publications, 2015.

REFERENCE BOOKS:

1. Palanikumar, K. "Basic Mechanical Engineering", ARS Publications, 2010.
2. Aruldhas G, "Quantum Mechanics", PHI Learning Pvt. Ltd.,New Delhi,2011.
3. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co.(P) Ltd.2013
4. Seetharaman S.,"Basic Civil Engineering",Anuradha Agencies,2005.
5. ShanthaKumar SRJ., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, 2000.
6. Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, 2000

		L	T	P	R	C
191ECC201T	**ELECTRIC CIRCUITS AND ELECTRONIC DEVICES**	**3**	**2**	**0**	**0**	**4**

PREREQUISITES: NIL

UNIT I : BASIC CIRCUIT ANALYSIS **12**

Kirchhoff's laws– Mesh current and node voltage analysis for D.C and A.C. circuits - Network Theorems and applications: Thevenin's theorem, Norton's theorem, Superposition theorem, Reciprocity Theorem and Maximum power transfer theorem – Source transformation - Star-delta conversion.

UNIT II : TRANSIENT ANALYSIS AND RESONANCE **12**

Transient response of RC, RL and RLC circuits to excitation by Step Signal, Impulse Signal, Sinusoidal signal and exponential sources Parallel and series resonances – Bandwidth - Q factor - Selectivity – Mutual inductance – Coefficient of Coupling - Single tuned and Double tuned coupled circuits.

UNIT III : SEMICONDUCTOR DIODES **12**

PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, Transition and Diffusion Capacitances,

Switching Characteristics - Zener diode and its characteristics – Avalanche and Zener Breakdown mechanisms

UNIT IV : TRANSISTORS **12**

Principle and operation of PNP and NPN transistors –Early effect- Current equations – Input and Output characteristics of CE, CB, CC configurations – Hybrid-π model - h-parameter model, Ebers Moll Model – JFETs – Drain and Transfer characteristics - Current equations– MOSFET – Enhancement and depletion types - Characteristics – Comparison of BJT with JFET – Comparison of JFET with MOSFET.

UNIT V : SPECIAL SEMICONDUCTOR DEVICES **12**

Metal-Semiconductor Junction MESFET- FINFET, PINFET, CNTFET, DUAL GATE MOSFET, Tunnel diodes – Schottky barrier diode- Varactor diode – UJT, SCR, Diac and Triac – Gallium Arsenide device- LED, Laser diode, Photodiode, Photo transistor, Opto Coupler, Solar cell, CCD.

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Analyze the A.C and D.C. electric circuits and apply the circuit theorems
2. Understand the concepts of transient analysis of RL,EC and RLC circuits
3. Explain the concepts of resonance and tuned coupled circuits
4. Explain the characteristics of diode, BJT and MOSFET
5. Describe the operation of metal-semiconductor junction devices, power control devices and opto-electronic devices.

TEXT BOOKS:

1. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuit Analysis”, McGraw Hill Science Engineering, Eighth Edition, 11th Reprint 2016.
2. Donald A Neaman, “Semiconductor Physics and Devices”, Fourth Edition, Tata Mc GrawHill Inc.2012

REFERENCE BOOKS:

1. Joseph Edminister and Mahmood Nahvi," Electric Circuits", Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint2016.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Fifth Edition, McGraw Hill, 9th Reprint2015.
3. Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory", Pearson Prentice Hall, 10th edition, July2008.
4. R.S.Sedha, " A Text Book of Applied Electronics" S.Chand Publications, 2006.
5. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A," Electronic Devices and Circuits", Third Edition, Tata McGraw- Hill, 2008.

		L	T	P	R	C
191GES211L	**ENGINEERING PRACTICES LABORATORY**	**0**	**0**	**4**	**0**	**2**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To provide exposure to the students with the concepts involved in product realization by carrying out manufacturing shop exercises. Hands-on practice with manufacturing shop exercises and assembly leading to realization of a new product in a group.

GROUP A (CIVIL & MECHANICAL)

CIVIL & MECHANICAL ENGINEERING PRACTICE

I CIVIL ENGINEERING PRACTICE

A. Plumbing Works:

1. Pipeline joints, its location and functions: Valves, Taps, Couplings, Unions, Reducers, Elbows in household fittings.
2. Connection of two Galvanized Iron pipes
3. Connection of PVC pipes

4. Basic pipe connections involving the fitting like Valves, Taps and Bends

B. Carpentry works:

1. Joints in Roofs, Doors, Windows and Furniture.
2. Cross Lap joint
3. Mortise and Tenant joint

II MECHANICAL ENGINEERINGPRACTICE

A. Welding:

1. Arc welding of Butt joints, Tap joints and Tee joints.
2. Gas welding practice

B. Basic machining:

1. Simple Turning and Taper turning
2. Drilling practice

C. Sheet metal work:

1. Rectangular tray making
2. Funnel making

TOTAL PERIODS: HOURS 30

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICALENGINEERINGPRACTICE

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.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment

IV ELECTRONICS ENGINEERING PRACTICE

7. Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak- peak, RMS period, frequency) using CRO.

8. Logic gates AND, OR, EX-OR and NOT.
9. Generation of Clock Signal.
10. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
11. Measurement of ripple factor of HWR and FWR.

TOTAL PERIODS: 30 HOURS

COURSE OUTCOMES:

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

1. Fabricate carpentry components and pipe connections including plumbing works.
2. Use welding equipments to join the structures.
3. Carry out the basic machining operations
4. Make the models using sheet metal works
5. Carry out basic home electrical works and Understand works of Home Appliances
6. Measure the electrical quantities
7. Elaborate on the Electronic components, Logic gates and soldering practice

		L	T	P	R	C
191ECC211L	**CIRCUITS AND DEVICES LABORATORY**	**0**	**0**	**3**	**1**	**2**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To gain hands on experience in KVL, KCL, Thevenin, Norton, Super Position, Maximum Power Transfer and Reciprocity Theorems
- To understand the concept of Resonance circuits
- To learn the characteristics of basic electronic devices such as Diode, BJT, JFET, SCR, DIAC, TRIAC, UJT,and Photo Devices
- To gain hands on experience in Electron Devices using simulation software

LIST OF EXPERIMENTS

1. Verifications of KVL and KCL
2. Verifications of The venin and Norton Theorem
3. Verifications of Super Position Theorem
4. Verifications of Maximum Power Transfer Theorem
5. Verifications of Reciprocity theorem
6. Determination of Resonance Frequency of Series and Parallel RLC Circuits
7. V-I Characteristics of PN Junction Diode and Zener Diode
8. Common Emitter input-output Characteristics
9. Common Base input-output Characteristics
10. Drain and Transfer characteristics of JFET
11. V-I characteristics of Thyristors (SCR/DIAC/TRIAC)
12. V-I characteristics of UJT
13. V-I characteristics of Photo Diode and Photo Transistor
14. Simulation of V-I characteristics of Electron Devices using PSPICE/Multisim

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Verify KVL, KCL, Thevinin, Norton, Super Position, Maximum Power Transfer and Reciprocity Theorem
2. Design Resonance circuits
3. Analyze the characteristics of basic electronic devices
4. Synthesis the characteristics of Electron Devices using simulation software
5. Identify and apply electron devices for specific applications

191CYM201T	ENVIRONMENTAL SCIENCE	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To appreciate and acquire knowledge about nature, environmental education and biodiversity.
- To understand the interrelationship between living organism and environment, environment functions and its value.
- To assess the environmental pollution and its impact on the human world.
- To find and implement scientific, economic and political solutions to environmental problems.
- To gain knowledge about waste management and resource recovery for protecting the environment.

UNIT I : ENVIRONMENT AND BIODIVERSITY 9

Definition and scope of an environment – structure of an ecosystem – biotic and abiotic components– ecological succession – food chain, food web – Introduction to biodiversity definition, types – biogeographically classification of India, India as a mega-diversity nation – values of biodiversity– endangered and endemic species of India hot-spots of biodiversity – threats to biodiversity – conservation of biodiversity

UNIT II : NATURAL RESOURCES AND ITS CONSERVATION 9

Forest resources - Uses and over exploitation, Deforestation, causes and its effects - Water Resources – Uses and over utilization - Water conservation- Dams, benefits and their effects, Rain Water Harvesting, Watershed Management – Mineral resources - Uses and exploitation, Food resources- World food problems - Effects of modern agriculture – Energy resources - Ocean energy, Geothermal energy, Biomass energy

UNIT III : ENVIRONMENTAL DEGRADATION 9

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Noise pollution (e) Thermal

pollution – role of an individual in prevention of pollution – pollution case studies – disaster management: cyclone, flood, drought, earthquake and landslides - case studies

UNIT IV : SOCIAL ISSUES 9

Population and Sustainability: Population explosion - Sustainable development – Equitable use of resources for sustainable lifestyles-urban problems related to energy - Role of information technology in environment and human health.

Industrial effluent treatment: Removal of organic constituents-Biological oxidation process-Removal of inorganic constituents-Metal and radioactive wastes, zero liquid discharge solutions from textile industries.

UNIT IV : WASTE MANAGEMENT AND RESOURCE RECOVERY 9

Introduction –Biodegradable, non-biodegradable waste, Municipal solid waste and its management - Special waste – E- waste and Scrap tires - Definition, causes, effects and its management - Resource recovery: a) Waste land reclamation b) Sewage treatment c) Recycling of Plastic, Glass and Paper wastes.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Environmental education initiates an awareness, deeper understanding and sensitivity to the environment and environmental challenges.
2. Acquired knowledge about the principles of nature, environment and their protection
3. Created an involvement to the public to implement environmental laws effectively.
4. Environmental education allows an individual to explore and think about the modern lifestyle has lead to serious environmental disasters and should develop the skills to make responsible decisions.

5. Acquired skills to behave ecofriendly.

TEXT BOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi,2006.
2. Handbook of Solid Waste Management (McGraw-Hill Handbooks), George Tchobanoglous, Frank Kreith, Publisher: McGraw-Hill Education; 2 edition July,2002

REFERENCE BOOKS:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
3. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press 2005.
4. Waste Management and Resource Recovery ,CharlesR .Rhyner, LeanderJ .Schwartz, RobertB .Wenger, MaryG. Kohrell, CRC Press Published August 31, 1995.
5. Industrial waste water management, treatment and disposal, Water management" Federation Alexandria Virgiia, Third Edition,2008.

191MAB303T	**LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS**	**L**	**T**	**P**	**R**	**C**
		3	**2**	**0**	**0**	**4**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
- To understand the concepts of vector space, linear transformations and diagonalization.
- To apply the concept of inner product spaces in orthogonalization.

- To understand the procedure to solve partial differential equations.
- To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

UNIT I : VECTOR SPACES **12**

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

UNIT II : LINEAR TRANSFORMATION AND DIAGONALIZATION **12**

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Eigenvalues and eigenvectors - Diagonalizability.

UNIT III : INNER PRODUCT SPACES **12**

Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

UNIT IV : PARTIAL DIFFERENTIAL EQUATIONS **12**

Formation – Solutions of first order equations – Standard types and equations reducible to standard types – Singular solutions – Lagrange‘s linear equation – Classification of partial differential equations - Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations (Exponential, sin(ax+by) and cos(ax+by)).

UNIT V : FOURIER SERIES SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS **12**

General Fourier series – Half range sine and cosine series - Solutions of one dimensional wave equation and one-dimensional heat equation (only problems on zero boundary). Steady state solution of two-dimensional heat equation (only problems on zero boundary).

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
2. Demonstrate accurate and efficient use of advanced algebraic techniques.
3. Demonstrate their mastery by solving non - trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
4. Able to solve various types of partial differential equations.
5. Able to solve engineering problems using Fourier series

TEXT BOOKS:

1. Friedberg, A.H., Insel, A.J. and Spence, L., “Linear Algebra”, Prentice Hall of India, New Delhi, 2004.
2. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCE BOOKS:

1. James, G. “Advanced Modern Engineering Mathematics”, Pearson Education, 2007.
2. Kolman, B. Hill, D.R., “Introductory Linear Algebra”, Pearson Education, New Delhi, First Reprint, 2009.
3. Kumaresan, S., “Linear Algebra – A Geometric Approach”, Prentice – Hall of India, New Delhi, Reprint, 2010.
4. Lay, D.C., “Linear Algebra and its Applications”, 5th Edition, Pearson Education, 2015.
5. O‘Neil, P.V., “Advanced Engineering Mathematics”, Cengage Learning, 2007.
6. Strang, G., “Linear Algebra and its applications”, Thomson (Brooks/Cole), New Delhi, 2005

191ECC301T	ELECTRONIC CIRCUITS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To understand the methods of biasing transistors
- To analyze single stage and multistage amplifier circuits
- To analyze the frequency response of small signal amplifiers
- To understand the concept of regulated DC power supplies
- To study about feedback amplifiers

UNIT I : BIASING OF BJT AND FET **9**

BJT– Need for biasing - DC Load Line and Bias Point – DC analysis of Transistor circuits - Various biasing methods of BJT -Thermal stability - Stability factors - Bias compensation techniques –JFET – DC/AC Load Line and Bias Point - Various biasing methods of JFET.

UNIT II : ANALYSIS OF BJT AND FET AMPLIFIER **9**

Small Signal Hybrid π equivalent circuit of BJT and FET – Early effect - Analysis of CE, CC and CB amplifiers using Hybrid π equivalent circuits - Analysis of CS, CD and CG amplifiers using Hybrid π equivalent circuits - Darlington Amplifier - Bootstrap technique - Cascade, Cascode configurations.

UNIT III : FREQUENCY RESPONSEOFAMPLIFIERS **9**

Amplifier frequency response – Frequency response of transistor amplifiers with circuit capacitors - BJT and FET frequency response – short circuit current gain of BJT and FET – Miller effect.

UNIT IV : POWER SUPPLIES **9**

Linear mode power supply – Rectifiers - Types – Filters - Types- Voltage regulators: Linear series, shunt and switching Voltage Regulators- Switched mode power supply (SMPS) - Over voltage protection.

UNIT V : FEEDBACK AMPLIFIERS 9

Feedback Concepts – gain with feedback – effect of feedback on gain stability, distortion, bandwidth, input and output impedances; topologies of feedback amplifiers – analysis of series-series, shunt-shunt and shunt-series feedback amplifiers.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Acquire knowledge of Working principles, characteristics and applications of BJT and FET
2. Frequency response characteristics of BJT and FET amplifiers
3. Analyze the performance of small signal BJT and FET amplifiers - single stage and multi stage amplifiers
4. Apply the knowledge gained in the design of Electronic circuits
5. Design and analyze feedback amplifiers

TEXT BOOKS:

1. Donald. A. Neamen, “Electronic Circuits Analysis and Design”, 3rd Edition, Mc Graw Hill Education (India) Private Ltd., 2010. (Unit I-IV)
2. Robert L. Boylestadand , Louis Nasheresky, “Electronic Devices and Circuit Theory”, 11thEdition, Pearson Education, 2013. (UnitV)

REFERENCE BOOKS:

1. Anwar A. Khan and Kanchan K. Dey, “A First Course on Electronics”, PHI, 2006.
2. David A. Bell, “Electronic Devices & Circuits”, 5th Edition, Oxford University Press, 2008
3. Floyd, “Electronic Devices”, Ninth Edition, Pearson Education, 2012
4. Millman J, Halkias.C.andSathyabradaJit, “Electronic Devices and Circuits”, 4th Edition, Mc Graw Hill Education (India) Private Ltd., 2015.

5. Rashid M, “Microelectronics Circuits”, Thomson Learning, 2007.
6. Salivahanan and N. Suresh Kumar, “Electronic Devices and Circuits”, 4th Edition, Mc Graw Hill Education (India) Private Ltd., 2017.

191ECC302T CONTROL SYSTEM ENGINEERING

L	T	P	R	C
3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To introduce the components and the representations of control systems
- To introduce methods for analyzing the time response of the systems
- To introduce methods for analyzing the frequency response of the systems.
- To analyze the stability of systems using various techniques.
- To learn the various approaches for state variable analysis.
- To model a given system, analyze and test the stability of the modeled system

UNIT I : SYSTEMS COMPONENTS AND THEIR REPRESENTATION 9

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

UNIT II : TIME RESPONSE ANALYSIS 9

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD, PI,PID control systems.

UNIT III : FREQUENCY RESPONSE AND SYSTEM ANALYSIS 9

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

UNIT IV : CONCEPTS OF STABILITY ANALYSIS 9

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

UNIT V : CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9

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

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Identify the various control system components and their representations.
2. Analyze the various time domain parameters.
3. Analysis the various frequency response plots and its system.
4. Apply the concepts of various system stability criterions.
5. Design various transfer functions of digital control system using state variable models.
6. Model, analyze and test the given system for stability.

TEXT BOOKS:

1. Gopal M., “Control System- Principles and Design”, Tata McGraw Hill, 4th Edition, 2012.

REFERENCE BOOKS:

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

191ECC303T	SIGNALS AND SYSTEMS	L	T	P	R	C
		3	2	0	0	4

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To mathematically and pictorially represent signals and systems.
- To have an insight into the properties of signals and systems.
- To know the methods of characterization of LTI systems in time domain
- To introduce the applications of Laplace and Fourier transforms in the analysis of continuous time signals
- To introduce the applications of Fourier and Z transforms in the analysis of discrete time signals

UNIT I : CLASSIFICATION OF SIGNALS AND SYSTEMS 12

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

UNIT II : ANALYSIS OF CONTINUOUS TIME SIGNALS 12

Fourier series analysis- Spectrum of Continuous Time (CT) signals, Fourier and Laplace Transforms in Signal Analysis and its properties.

UNIT III : LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 12

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

UNIT IV : ANALYSIS OF DISCRETE TIME SIGNALS 12

Baseband Sampling of CT signals- Aliasing, Reconstruction of CT signal from DT signal – Fourier Transform of discrete time signals – Properties of Discrete Time Fourier Transform– Z - Transform & Properties

UNIT V : LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 12

Difference equation-Convolution sum- Discrete Fourier Transform and Z-Transform, Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel**.**

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Classify signals and systems based on various characteristics.
2. Determine, analyze frequency components of signals and frequency response of the systems.
3. Determine and analyze the causality and stability of LTI systems from their impulse responses.
4. Convert the CT signals into DT signals and analyze the effect of sampling and frequency content of DT signals.
5. Analyze LTI systems and realize using various structures

TEXT BOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson, Indian Reprint, 2007.

REFERENCE BOOKS:

1. Haykin S. and Van Veen B., "Signals and Systems", 2nd Edition, Wiley, 2003
2. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 2007
3. Lathi B. P., “Principles of Linear Systems and Signals”, Second Edition, Oxford, 2009.
4. Roberts M.J., "Signals & Systems, Analysis, using Transform methods & MATLAB”, TataMcGraw Hill (India), 2007
5. Zeimer R.E., Tranter W.H. and Fannin R.D., “Signals & Systems - Continuous and Discrete”, Pearson, 2007.

191ECS301T	DIGITAL ELECTRONICS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To understand the digital fundamentals, Boolean algebra and its applications in digital system
- To design the 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

UNIT I : DIGITAL FUNDAMENTALS **9**

Binary arithmetic and complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and Product of sums, Minterms and Maxterms, Karnaugh map 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, Priority Encoder-Introduction to HDL, HDL models of Combinational Circuits

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- HDL models of Sequential Circuits.

UNIT IV : ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

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

UNIT V : MEMORY DEVICES AND PROGRAMMABLE LOGIC 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 and PAL.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Understand Boolean algebra and design logic circuits using logic gates by applying DeMorgan's Theorems and Karnaugh Maps
2. Design various combinational digital circuits using logic gates
3. Design and analyze of synchronous and asynchronous sequential circuits using logic gates
4. Design and analyze of combinational and sequential logic circuits through HDL models
5. Assess the nomenclature and technology in the area of memory devices
6. Design and analyze digital system design using PLD

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 5th Edition, Pearson, 2014.

REFERENCE BOOKS:

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

E-BOOKS / WEB REFERENCES:

1. Edutechlearners.com/digital-design-by-morris-mano-free-download-pdf/
2. nptel.ac.in/courses/108/105/108105132/

191ECC311L ANALOG CIRCUITS LABORATORY

L	T	P	R	C
0	0	4	0	2

PREREQUISITES: NIL

COURSE OBJECTIVES:

- Obtain the frequency response& bandwidth of BJT & FET amplifiers.
- Study the transfer characteristics of differential amplifier.
- Simulate frequency response of amplifiers using SPICE

LIST OF EXPERIMENTS

1. Design of Regulated Power Supplies.
2. Frequency Response of CE /CB /CC amplifiers& determine

bandwidth.

3. Frequency Response of CS amplifiers& determine bandwidth.
4. Frequency Response of Darlington Amplifier.
5. Differential Amplifiers - Transfer characteristics, CMRR Measurement.
6. Frequency Response of Cascade amplifiers.
7. Frequency Response of multistage amplifiers & determine bandwidth.
8. Frequency Response analysis of BJT with Voltage divider bias using SPICE.
9. Frequency Response analysis of FET/ MOSFET with Voltage divider bias using SPICE.
10. Frequency Response analysis of Cascode/Cascade amplifier using SPICE.

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Design and test rectifiers, filters and regulated power supplies.
2. Design and test BJT/JFET amplifiers.
3. Differentiate cascode and cascade amplifiers.
4. Analyze the limitation in bandwidth of single stage and multi stage amplifier.
5. Measure CMRR in differential amplifier.
6. Simulate and analyze amplifier circuits using PSPICE

191ECS312L	**DIGITAL CIRCUITS LABORATORY**	**L**	**T**	**P**	**R**	**C**
		0	**0**	**3**	**1**	**2**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- Design and implement the combinational logic circuits.
- Design and implement the sequential logic circuits
- Simulate Digital circuits using Verilog / VHDL coding

LIST OF EXPERIMENTS

1. Design and implementation of Adders and Subtractors using logic gates.
2. Design and implementation of code converters using logic gates - binary to gray and vice-versa.
3. Design and implementation of 4 bit binary Adder/ Subtractor using IC 7483.
4. Design and implementation of 4 bit BCD adder using IC 7483.
5. Design and implementation of Multiplexer and De-multiplexer using logic gates / MSI devices.
6. Design and implementation of encoder and decoder using logic gates / MSI devices.
7. Construction and verification of asynchronous counters.
8. Design and implementation of synchronous counters.
9. Simulation of combinational circuits using Verilog/ VHDL.
10. Simulation of sequential circuits using Verilog/ VHDL.
11. Mini project

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Design and troubleshoot the combinational logic circuits.
2. Design and troubleshoot the sequential logic circuits.
3. Simulate Digital circuits using Verilog / VHDL coding.

		L	T	P	R	C
191MAB404T	**PROBABILITY AND RANDOM PROCESS**	**3**	**2**	**0**	**0**	**4**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- 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.

UNIT I : PROBABILITY AND RANDOM VARIABLES 12

Probability review – Baye's theorem - 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 – Markov process - Markov chain - 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 SYSTEMS WITH RANDOM INPUTS 12

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

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

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

2. Understand the basic concepts of one and two dimensional random variables and apply in engineering applications
3. Apply the concept random processes in engineering disciplines.
4. Understand and apply the concept of correlation and spectral densities.
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.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Cooper. G.R., McGillem. C.D., "Probabilistic Methods of Signal and System Analysis", Oxford University Press, New Delhi, 3rd Indian Edition, 2012.
2. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes ", Tata McGraw Hill Edition, New Delhi, 2004.
3. Miller. S.L. and Childers. D.G., "Probability and Random Processes with Applications to Signal Processing and Communications ", Academic Press, 2004.

191ECC401T	**ANALOG AND INTEGRATED CIRCUITS**	**L**	**T**	**P**	**R**	**C**
		3	**0**	**0**	**0**	**3**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To give a comprehensive exposure to all types oscillators
- To study about wave shaping circuits and Multivibrators

- To study about tuned amplifiers and power amplifiers
- To introduce the basic building blocks of linear integrated circuits and to learn the applications of operational amplifiers
- To introduce the theory and applications of waveform generators and PLL
- To learn the theory of ADC and DAC

UNIT I : OSCILLATORS AND WAVE SHAPING CIRCUITS 9

Barkhausen Criterion for oscillation – RC oscillators using BJT - LC oscillators using BJT and crystal oscillators - UJT Oscillator - Integrator - differentiator– clampers and clippers –Multivibrators-Astable and Monostable.

UNIT II : TUNED AMPLIFIERS AND POWER AMPLIFIERS 9

Coil losses, unloaded and loaded Q of tank circuits-Analysis of single tuned amplifier double tuned amplifier – effect of cascading single tuned amplifiers on bandwidth – Stagger tuned amplifiers – Stability of tuned amplifiers – Neutralization – Hazeltine neutralization method – Power amplifiers: Class A- Class B-Class AB-Class C power amplifiers.

UNIT III : BASICS OF OPERATIONALAMPLIFIERS 9

General operational amplifier stages (IC 741)- Ideal characteristics– Inverting and Non inverting amplifier- DC and AC characteristics-Applications: Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Integrator–differentiator, Instrumentation amplifier, Logarithmic amplifier, Anti-logarithmic amplifier, Comparators, Schmitt trigger, Low-pass, high-pass and band-pass Butterworth filters

UNIT IV : MULTIVIBRATORS AND PLL 9

Multivibrators: Astable and Monostable using IC741and Timer IC 555 – Sine wave generators – Triangular wave generator -Operation of the basic PLL, Voltage Controlled Oscillator - application of PLL.

UNIT V : ANALOG TO DIGITAL AND DIGITAL TOANALOG CONVERTERS 9

D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current- Mode *R* - 2RLadder types - high

speed sample-and-hold circuits, A/D Converters – specifications – Flash type - Successive Approximation type - Single Slope type – Dual Slope type.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Analyze different types oscillator and multivibrator circuits
2. Design Tuned amplifiers and power amplifiers
3. Design linear and non linear applications of OP –AMPS
4. Develop applications using PLL and Multivibrator
5. Design ADC and DAC using OP –AMPS
6. Generate waveforms using OP – AMP Circuits

TEXT BOOKS:

1. Jacob Millman, "Microelectronics', McGraw Hill, 2nd Edition, Reprinted, 2009. (UNIT I,II,IV,V)
2. Sedra and Smith, "Micro Electronic Circuits"; Sixth Edition, Oxford University Press, 2011. (UNIT I, III,IV,V)
3. Roy Choudhry D., Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2018, Fifth Edition. (Unit III – V)
4. Sergio Franco,"Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, Tata Mc Graw-Hill, 2016 (Unit III – V)

REFERENCE BOOKS:

1. David A. Bell,"—Electronic Devices and Circuits", Fifth Edition, Oxford University Press,2008.
2. Millman J.andTaubH., "Pulse Digital and Switching Waveforms", TMH, 2000.
3. Millman and Halkias. C., "Integrated Electronics", TMH, 2007.
4. Ramakant A. Gayakwad,"—OP-AMP and Linear ICs"', 4thEdition, Prentice Hall/ Pearson Education, 2015.
5. Robert F. Coughlin, Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI,2001.

6. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 10th Edition, Pearson Education / PHI, 2008

191ECC402T	ANALOG AND DIGITAL COMMUNICATION	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To understand the spectrum of AM and FM
- To analyze the various analog and pulse modulation techniques
- To compare the various keying techniques and understand the constellation diagram.
- To evaluate the source coding techniques and analyze the error coding techniques
- To apply the concepts of PN sequence in spread spectrum and multiple access techniques

UNIT I : ANALOG MODULATION **9**

Amplitude Modulation – Comparison of AM, DSBSC, SSBSC, VSB – Angle modulation – PM and FM, Superheterodyne receivers.

UNIT II : PULSE MODULATION **9**

Low pass sampling theorem – Quantization –Comparison of PCM, DPCM, DM and ADM, Time Division Multiplexing-Line coding

UNIT III : DIGITAL MODULATION AND TRANSMISSION **9**

Phase shift keying – BPSK, BFSK,QPSK ,QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Eye pattern, Equalizers

UNIT IV : INFORMATION THEORY AND CODING **9**

Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding– Channel capacity –– Error

control codes – Linear and Cyclic codes, Convolutional Codes, Viterbi algorithm

UNIT V : SPREAD SPECTRUM AND MULTIPLE ACCESS 9

PN sequences – Properties – DSSS, FHSS– Processing gain, Jamming margin –Multiple Access – FDMA, TDMA, CDMA.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Understand the spectrum of AM and FM
2. Analyze the various analog and pulse modulation techniques
3. Compare the various keying techniques and understand the constellation diagram
4. Evaluate the source coding techniques and analyze the error coding techniques
5. Apply the concepts of PN sequence in spread spectrum and multiple access techniques

TEXT BOOKS:

1. Haykin S., “Digital Communications” John Wiley 2005.
2. Sanjay Sharma, “Communication Systems (Analog and Digital), S.K.Kataria & Sons
3. Taub H, D L Schilling, G Saha, “Principles of Communication Systems” 3/e, TMH 2007

REFERENCE BOOKS:

1. Hsu H P, Schaum Outline Series, “Analog and Digital Communications” TMH 2006.
2. Lathi B.P., “Modern Digital and Analog Communication Systems”, 3rd edition, Oxford University Press, 2007.
3. Martin S.Roden, “Analog and Digital Communication System”, Prentice Hall of India, 2002.

191ECC403T	ENGINEERING ELECTROMAGNETICS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To gain conceptual and basic mathematical understanding of electric and magnetic fields in free space and in materials.
- To understand the coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations.
- To understand wave propagation in lossless and in lossy media
- To be able to solve problems based on the above concepts

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, Null identities

UNIT II : ELECTROSTATICS **9**

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

UNIT III : MAGNETOSTATICS **9**

Lorentz force equation, Law of no magnetic monopoles, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy, Magnetic forces and torques.

UNIT IV : TIME-VARYING FIELDS AND MAXWELL's EQUATIONS 9

Faraday's law, Displacement current and Maxwell-Ampere's law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields.

UNIT V : PLANE ELECTROMAGNETIC WAVES 9

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

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Display an understanding of fundamental electromagnetic laws and concepts
2. Write Maxwell's equations in integral, differential and phasor forms and explain their physical meaning
3. Explain electromagnetic wave propagation in lossy and in lossless media
4. Solve simple problems requiring estimation of electric and magnetic field quantities based on these concepts and laws.

TEXT BOOKS:

1. Cheng D.K., Field and wave Electromagnetics, 2nd ed., Pearson (India), 1989 (UNIT I, II,III IV,V)
2. Hayt W.H. and Buck J.A., Engineering Electromagnetics, 7th ed., McGraw-Hill (India), 2006 (UNIT I-V)

REFERENCE BOOKS:

1. Griffiths D.J., Introduction to electrodynamics, 4th ed., Pearson (India), 2013
2. Notaros B.M., Electromagnetics, Pearson: New Jersey, 2011
3. Sadiku M.N.O. and Kulkarni S.V., Principles of Electromagnetics, 6th ed., Oxford (Asian Edition), 2015

191CSS421T	OOPS AND DATA STRUCTURES	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To comprehend the fundamentals of object oriented programming, particularly in C++.
- To use object oriented programming to implement Inheritance and Polymorphism
- To introduce linear data structures and their applications.
- To introduce Non- linear data structures and their applications
- To enable the students to learn Sorting and Searching concepts

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 – Overriding – Public, Protected and Private Inheritance – Constructors and Destructors in derived Classes – Class Object To Base – Class Object Conversion – Composition Vs. Inheritance – Virtual functions – This Pointer –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 – Binary Search trees - Application of trees– Graph and its

representations – Graph Traversals – Representation of Graphs – Breadth-first search – Depth-first search - Connected components.

UNIT V : SORTING and SEARCHING 9

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

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Explain the concepts of Object oriented programming.
2. Write simple applications using C++.
3. Discuss the different methods of organizing large amount of data.
4. Understand non linear data structures and their applications
5. Implement different types of sorting and searching techniques

TEXT BOOKS:

1. Deitel and Deitel, “C++, How To Program”, Fifth Edition, Pearson Education, 2005.
2. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Third Edition, Addison- Wesley, 2007

REFERENCE BOOKS:

1. Bhushan Trivedi, “Programming with ANSI C++, A Step-By-Step approach”, Oxford University Press, 2010.
2. Bjarne Stroustrup, “The C++ Programming Language”, 3rd Edition, Pearson Education, 2007.
3. Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, “Fundamentals of Data Structures in C++”, Galgotia Publications, 2007.
4. Goodrich, Michael T., Roberto Tamassia, David Mount, “Data Structures and Algorithms in C++”, 7th Edition, Wiley, 2004.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Second Edition, Mc Graw Hill, 2002.

191ECC411L	CIRCUITS DESIGN AND SIMULATION LABORATORY	L	T	P	R	C
		0	0	4	0	2

PREREQUISITES: NIL

COURSE OBJECTIVES:

- Analyze feedback amplifier and its gain - bandwidth characteristics.
- Design Oscillators, tuned amplifiers.
- Understand the operation of wave shaping circuits.
- Design filters using OP-AMP and to analyze the frequency response.
- Analyze the performance of various sinusoidal and non sinusoidal circuits using PSPICE tool.

LIST OF EXPERIMENTS

DESIGN AND TESTING OF THE FOLLOWING CIRCUITS:

1. Series feedback amplifier
2. Hartley Oscillator and Colpitts Oscillator
3. Single Tuned Amplifier
4. RC Integrator and Differentiator circuits
5. Inverting, non-inverting and differential amplifiers (using OP-AMP)
6. Instrumentation amplifier (using OP-AMP)
7. Astable, Monostable multivibrator and Schmitt trigger (using OP-AMP)
8. RC phase shift and Wein bridge oscillator (using OP-AMP)

SIMULATION USING PSPICE :

9. Wein Bridge Oscillator(Using transistor)
10. Double tuned Amplifier (Using transistor)
11. Schmitt Trigger circuit with Predictable hysteresis (Using transistor)
12. Analysis of power Amplifier (Using transistor)
13. Active Lowpass, high pass and band pass filter (using OP-AMP)
14. A/ D and D/A converter(using OP-AMP)

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Analyze the performance of various amplifiers designed using transistor and OP-AMP.
2. Design oscillators, wave-shaping circuits and multivibrators.
3. Design and simulate oscillators, tuned amplifier, wave-shaping circuits and power amplifier using SPICE Tool.
4. Apply the knowledge to design filters, converters and instrumentation amplifiers

		L	T	P	R	C
191ECC412L	**COMMUNICATION SYSTEMS LABORATORY**	**0**	**0**	**3**	**1**	**2**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To visualize the effects of sampling and TDM
- To Implement AM & FM modulation and demodulation
- To implement PCM
- To implement FSK, PSK and ASK schemes
- To implement Error control coding schemes

LIST OF EXPERIMENTS

1. Signal Sampling and reconstruction
2. Time Division Multiplexing
3. AM Modulation and Demodulation
4. FM Modulation and Demodulation
5. Pulse Code Modulation and Demodulation
6. Line coding schemes
7. ASK,FSK and PSK
8. Convolutional encoder and decoder
9. Signal constellations of BPSK, QPSK and QAM (Simulink)
10. Error control coding schemes - Linear Block Codes (MATLAB Simulation)
11. Cyclic codes (MATLAB Simulation)
12. Communication link simulation

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Understand the effects of sampling and TDM
2. Calculate the different modulation index in AM and analyse the waveforms
3. Understand the various stages in a PCM system
4. Demonstrate their knowledge in base band signalling schemes through implementation of FSK, PSK and ASK
5. Apply various error coding schemes & demonstrate their capabilities towards the improvement of the noise performance of communication system
6. Simulate end-to-end Communication Link

		L	T	P	R	C
191CSS431L	**OOPS AND DATA STURUCTURES LABORATORY**	**0**	**0**	**4**	**0**	**2**

PREREQUISITES: NIL

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS

DESIGN AND TESTING OF THE FOLLOWING CIRCUITS:

1. Implement Structures in C++
2. Friend function
3. Overloading: Function overloading and Operator Overloading.
4. Inheritance
5. Constructors and Destructors in derived Classes
6. Virtual functions
7. List ADT - Array and Single linked list implementations
8. Stack ADT - Array and linked list implementations
9. Queue ADT - Array and linked list implementations
10. Evaluating arithmetic expressions using stack

11. Binary Search Tree ADT
12. Tree traversals
13. Insertion Sort
14. Quick Sort
15. Linear Search and Binary Search

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Design and implement C++ programs for manipulating stacks, queues, linked lists, trees, and graphs.
2. Apply good programming design methods for program development.
3. Apply the different data structures for implementing solutions to practical problems.

		L	T	P	R	C
191ECC501T	**MICROPROCESSORS AND MICROCONTROLLERS**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To understand the architecture and programming of 8086 microprocessor
- To learn the design aspects of I/O and Memory Interfacing circuits
- To interface microprocessors with supporting chips
- To study the architecture and programming of 8051 microcontroller
- To design a microcontroller based system

UNIT I : THE 8086 MICROPROCESSOR **9**

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

UNIT II : 8086 SYSTEM BUS STRUCTURE 9

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations

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, Keyboard display interface.

UNIT IV : THE 8051 MICROCONTROLLER 9

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming

UNIT V : INTERFACING MICROCONTROLLER 9

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC interfacing - Stepper Motor

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Understand and execute programs based on 8086 microprocessor.
2. Familiarize the concepts of multiprocessing and multiprogramming.
3. Design Memory interfacing circuits and I/O interfacing circuits.
4. Understand and execute programs based on 8051 microcontroller.
5. Design and implement 8051 microcontroller based systems

TEXT BOOKS:

1. Ray A.K., Bhurchandi K.M., "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGraw Hill, 2012.(UNIT I& III)
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C" Second Edition, Pearson education, 2011. (UNIT IV-V)
3. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design" Second Edition, Prentice Hall of India, 2007. (UNIT II)

REFERENCE BOOKS:

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

191ECC502T	**DISCRETE-TIME SIGNAL PROCESSING**	**L**	**T**	**P**	**R**	**C**
		3	**2**	**0**	**0**	**4**

PREREQUISITES: NIL

COURSE 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

UNIT : DISCRETE FOURIER TRANSFORM **12**

Discrete Fourier Transform (DFT) - Properties of DFT, Linear filtering using DFT, Radix-2 Fast Fourier Transform: Decimation-in-Time (DIT),

Decimation-in-Frequency (DIF).

UNIT II : INFINITE IMPULSE RESPONSE FILTERS 12

Characteristics of practical frequency selective filters. Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF), Digitization techniques: Impulse Invariance method, Bilinear Transformation Technique. Structure of IIR filter - Direct form -I, Direct form- II, Cascade-parallel form realizations.

UNIT III : FINITE IMPULSE RESPONSE FILTERS 12

Frequency response of FIR filters, Design of linear phase FIR filters: Fourier series method, Window Technique (Rectangular, Hamming and Hanning window) and Frequency sampling method. Structure of FIR filter - Direct form, linear phase, Cascade and Poly Phase realizations.

UNIT IV : FINITE WORD LENGTH EFFECTS 12

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 - scaling to prevent overflow.

UNIT V :INTRODUCTION TO DIGITAL SIGNAL PROCESSORS 12

DSP functionalities - circular buffering – DSP architecture of TMS320C5X– Fixed and Floating point architecture principles – Applications

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Apply DFT for the analysis of digital signals and systems
2. Design IIR filters
3. Design FIR filters
4. Characterize the effects of finite precision representation on digital filters
5. Apply adaptive filters appropriately in communication systems

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Andreas Antoniou, “Digital Signal Processing”, Tata Mc Graw Hill, 2006.
2. Venkataramani & M.Baskar,” Digital Signal Processors” Tata Mc Graw Hill, Second edition
3. Emmanuel C. Ifeachor & Barrie. W. Jervis, “Digital Signal Processing”, Second Edition,Pearson Education / Prentice Hall, 2002.
4. Oppenheim A. V., Schafer R.W. and Buck J.R., “Discrete-Time Signal Processing”, 8thIndian Reprint, Pearson, 2004.
5. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”, Tata Mc GrawHill, 2007.

		L	T	P	R	C
191ECC503T	**TRANSMISSION LINES AND RF SYSTEMS**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To introduce the various types of transmission lines and its characteristics
- To give thorough understanding about high frequency line, power and impedance measurements
- To impart technical knowledge in impedance matching using smith chart
- To introduce passive filters and basic knowledge of active RF components
- To acquire knowledge about RF system transceiver design

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 - Inductance Loading - Line not terminated in Z_0 - 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, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses on the unmatched line - Measurement of VSWR and wavelength.

UNIT III : IMPEDANCE MATCHING IN HIGH FREQUENCY LINES 9

The eighth-wave line, 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 : WAVEGUIDES 9

General Wave behavior along uniform guiding structures – Transverse Electromagnetic Waves, Transverse Magnetic Waves, Transverse Electric Waves – TM and TE Waves between parallel plates. Field Equations in rectangular waveguides, TM and TE waves in rectangular waveguides, Bessel Functions, TM and TE waves in Circular waveguides.

UNIT V : RF SYSTEM DESIGN CONCEPTS 9

Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors. Basic concepts of RF design, Mixers, voltage control oscillators, transducer power gain and stability considerations.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. To explain the characteristics of transmission lines and its losses
2. To write about the standing wave ratio and input impedance in high frequency transmission lines
3. Analyze impedance matching by stubs using Smith charts
4. Analyze the characteristics of TE and TM waves
5. Design a RF transceiver system for wireless communication

TEXT BOOKS:

1. John D Ryder, "Networks, lines and fields", 2nd Edition, Prentice Hall India, 2015. (UNIT I-IV).
2. Reinhold Ludwig and Powel Bretchko," RF Circuit Design – Theory and Applications", Pearson Education Asia, First Edition,2001. (UNIT-V).

REFERENCE BOOKS:

1. Jordan E.C. and Balmain K.G., "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2006.
2. Mathew M. Radmanesh, "Radio Frequency &Microwave Electronics", Pearson Education Asia, Second Edition, 2002.
3. Misra D. K., "Radio Frequency and Microwave Communication Circuits- Analysis and Design", John Wiley & Sons, 2004.
4. Raju G.S.N, "Electromagnetic Field Theory and Transmission Lines", Pearson Education, First edition 2005.

		L	T	P	R	C
191ECC511L	**MICROPROCESSORS AND MICROCONTROLLERS LABORATORY**	**0**	**0**	**3**	**1**	**2**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To Introduce ALP concepts, features and Coding methods
- 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

LIST OF EXPERIMENTS

8086 Programs using kits / MASM

1. Basic arithmetic and Logical operations
2. Move a data block without overlap and String manipulations
3. Code conversion and Matrix operations
4. Sorting and Searching

Peripherals and Interfacing Experiments

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

8051 Experiments using kits

10. Basic arithmetic and Logical operations
11. Square and Cube program, Find 2's complement of a number
12. Stepper motor control

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Write ALP and execute using 8086 microprocessor
2. Interface different I/Os with processor
3. Generate waveforms using microprocessor
4. Execute Programs in 8051
5. Explain the difference between simulator and emulator

191ECC512L	DISCRETE TIME SIGNAL PROCESSING LABORATORY	L	T	P	R	C
		0	0	4	0	2

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To perform basic signal processing operations such as Linear Convolution, Circular Convolution, Auto Correlation, Cross Correlation
- To perform basic signal processing operations such as Frequency analysis and Decimation & Interpolation in MATLAB
- To study the architecture of DSP processor and to perform basic signal processing operations using DSP Processor.
- To implement FIR and IIR filters in MATLAB and DSP Processor

LIST OF EXPERIMENTS

MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of elementary Discrete-Time sequences
2. Linear and Circular convolutions
3. Auto correlation and Cross Correlation
4. Frequency Analysis using DFT
5. Design of FIR filters (LPF/HPF/BPF/BSF)
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF)
7. Decimation and Interpolation

DSP PROCESSOR BASED IMPLEMENTATION

8. Study of architecture of Digital Signal Processor
9. Generation of various signals and random noise
10. Linear and Circular convolutions
11. Design of FIR filter (LPF/HPF/BPF/BSF)
12. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF)

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Carryout basic signal processing operations
2. Demonstrate their abilities towards MATLAB based implementation of various DSPsystems
3. Analyze the architecture of a DSP Processor
4. Design and Implement the FIR, IIR Filters in DSP Processor for performing filtering operation over real-time signals
5. Design a DSP system for various applications of DSP

		L	T	P	R	C
191LEH511L	**INTERPERSONAL SKILLS / LISTENING AND SPEAKING**	**0**	**0**	**2**	**0**	**1**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations.

UNIT I : **9**

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification Improving pronunciation – pronunciation basics taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to producing fragmented utterances

UNIT II : **9**

Listen to a process information- give information, as part of a simple explanation – conversation starters: small talk – stressing syllables

and speaking clearly – intonation patterns – compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III : 9

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer – accept – decline – take leave – listen for and follow the gist- listen for detail

UNIT IV : 9

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade.

UNIT V : 9

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations – negotiate disagreement in group work.

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Listen and respond appropriately.
2. Participate in group discussions
3. Make effective presentations
4. Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:

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 BOOKS:

1. Bhatnagar, Nitin and MamtaBhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.

191ECC601T	VLSI DESIGN	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- Study the fundamentals of CMOS circuits and its characteristics.
- Learn the design and realization of combinational & sequential digital circuits.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology
- Learn the different FPGA architectures and testability of VLSI circuits

UNIT I : INTRODUCTION TO MOS TRANSISTOR 9

MOS Transistor Theory, Long-Channel I-V Charteristics - CMOS Inverter, CMOS Fabrication, Layout Design Rules, Stick Diagrams, C-V Characteristics, Non ideal I-V Effects, DC Transfer characteristics, Scaling principles and fundamental limits, Device Modeling in SPICE

UNIT II : COMBINATIONAL LOGIC CIRCUIT DESIGN 9

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic CMOS, Pass Transistor Logic, Complementary Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, Differential Cascode Voltage Switch with Pass-Gate (DCVSPG) Power: Static Power and Dynamic Power Low Power Architecture.

UNIT III : SEQUENTIAL LOGIC CIRCUIT DESIGN 9

Timing Metrics for Sequential Circuits, Static Latches and Registers, Dynamic Latches and Registers, Pulse Registers, Sense-Amplifier Based Registers, Pipelining: An approach to optimize sequential circuits Timing Issues: Timing Classification Of Digital System, Synchronous Design.

UNIT IV : DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM 9

Arithmetic Building Blocks: Datapaths in Digital Processor Architectures, Adders, Multipliers, Shifters, Power and Speed trade-offs, Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

UNIT V : IMPLEMENTATION STRATEGIES AND TESTING 9

Full custom and Semi-custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA Interconnect Routing Procedures. Design for Testability: Ad Hoc Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Realize the concepts of digital building blocks using MOS transistor.
2. Design combinational MOS circuits and power strategies.
3. Design and construct Sequential Circuits and Timing systems.
4. Design arithmetic building blocks and memory subsystems.
5. Apply and implement FPGA design flow and testing.

TEXT BOOKS:

1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje. Nikolic, “Digital Integrated Circuits: A Design perspective”, Second Edition , Pearson , 2016.(UNIT II III,IV)
2. Neil H.E. Weste, David Money Harris, “CMOS VLSI Design: A Circuits and Systems Perspective”, 4th Edition, Pearson, 2017 (UNIT I,V)

REFERENCE BOOKS:

1. R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India 2005.
2. Smith M.J., "Application Specific Integrated Circuits", Addison Wesley, 1997
3. Sung-Mo kang, Yusuf leblebici, Chulwoo Kim, "CMOS Digital Integrated Circuits:Analysis&Design" ,4th edition McGraw Hill Education,2013
4. Wayne Wolf, "Modern VLSI Design: System On Chip", Pearson Education, 2007

E-BOOKS / WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc20_ee29/course

191ECC602T	ANTENNAS AND MICROWAVE ENGINEERING	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To enable the student to understand the basic principles in antenna and microwave system design
- To enhance the student knowledge in the area of various antenna designs.
- To enhance the student knowledge in the area of microwave components and antenna for practical applications

UNIT I : INTRODUCTION TO MICROWAVE SYSTEMS AND ANTENNAS 9

Microwave frequency bands, Physical concept of radiation, Near- and far-field regions, Fields and Power Radiated by an Antenna, Antenna Pattern Characteristics, Antenna Gain and Efficiency, Aperture Efficiency and Effective Area, Antenna Noise Temperature and G/T, Impedance matching, Friis transmission equation, Link budget and link margin, Noise Characterization of a microwave receiver.

UNIT II : RADIATION MECHANISMS AND DESIGN ASPECTS 9

Radiation Mechanisms of Linear Wire and Loop antennas, Aperture antennas, Reflector antennas, Microstrip antennas and Frequency independent antennas, Design considerations and applications

UNIT III : ANTENNA ARRAYS AND APPLICATIONS 9

Two-element array, Array factor, Pattern multiplication, Uniformly spaced arrays with uniform and non-uniform excitation amplitudes, Smart antennas.

UNIT IV : PASSIVE AND ACTIVE MICROWAVE DEVICES 9

Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, attenuator, resonator, Principles of Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes, Microwave tubes: Klystron, TWT, Magnetron.

UNIT V : MICROWAVE DESIGN PRINCIPLES 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 PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Apply the basic principles and evaluate antenna parameters and link power budgets
2. Design and assess the performance of various antennas
3. Design a microwave system given the application specifications

TEXT BOOKS:

1. David M. Pozar, "Microwave Engineering", Fourth Edition, Wiley India, 2012. (UNIT I,IV,V)
2. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation" Fourth Edition, Tata McGraw-Hill, 2006. (UNIT I, II, III)

REFERENCE BOOKS:

1. Collin R.E., "Foundations for Microwave Engineering", Second edition, IEEE Press, 2001
2. Constantine A. Balanis, “Antenna Theory Analysis and Design”, Third edition, John Wiley India Pvt Ltd., 2005.

191ECC603T	INTERNET OF THINGS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To understand the basics of Internet of Things
- To get an idea of some of the application areas where Internet of Things can be applied
- To understand the middleware for Internet of Things
- To understand the concepts of Web of Things
- To understand the concepts of Cloud of Things with emphasis on Mobile cloud computing
- To understand the IOT protocols

UNIT I : INTRODUCTION **10**

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security.

UNIT II : IOT PROTOCOLS **8**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security.

UNIT III : WEB OF THINGS **9**

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

UNIT IV : INTEGRATED SYSTEMS **9**

Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things - Network Dynamics: Population Models – Information Cascades - Network Effects - Network Dynamics: Structural Models - Cascading Behavior in Networks - The Small-World Phenomenon

UNIT V : APPLICATIONS **9**

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Identify and design the new models for market strategic interaction
2. Design business intelligence and information security for WoB
3. Analyze various protocols for IoT Design a middleware for IoT
4. Analyze and design different models for network dynamics

TEXT BOOKS:

1. David Easley and Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning About a Highly Connected World”, Cambridge University Press - 2010
2. Dieter Uckelmann; Mark Harrison; Florian Michahelles, “Architecting the Internet of Things”, Springer – 2011

3. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press – 2012

REFERENCE BOOKS:

1. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012
2. Olivier Hersent , Omar Elloumi and David Boswarthick , “The Internet of Things: Applications to the Smart Grid and Building Automation”, Wiley -2012

191ECC611L	VLSI DESIGN LABORATORY	L	T	P	R	C
		0	0	3	1	2

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To learn Hardware Descriptive Language(Verilog/VHDL)
- To learn the fundamental principles of VLSI circuit design in digital and analog domain
- To familiarize fusing of logical modules on FPGAs
- To provide hands on design experience with professional design EDA platforms

LIST OF EXPERIMENTS

Part I: Design the following Digital System using HDL &Implement by Xilinx/Altera FPGA (36 Periods)

1. Adder – Ripple Carry Adder/ Carry Lookahead Adder (Minimum 8 Bit)
2. Multiplier – Booth Multiplier/ Wallace Tree Multiplier/Array Multiplier (4 Bit Minimum)
3. Comparators, Decoders, Multiplexers and Demultiplexers
4. Arithmetic & Logic Unit (4 bit Minimum)
5. Latches & Flip-Flops
6. Universal Shift Register (4 bit Minimum)
7. Synchronous Counters (4 bit)
8. Finite State Machine (Moore/Mealy)
9. Random Access Memory(4X4)

Requirements for Part I: Xilinx ISE/Altera Quartus/ equivalent EDA Tools along with Xilinx/Altera/equivalent FPGA Boards

Part-II Analog Circuit Design (24 Periods)

10. Design and Simulate a CMOS Inverter by performing Schematic Simulations.
11. Design and simulate simple 5 transistor differential amplifier. Analyze Gain, Bandwidth and CMRR by performing Schematic Simulations.
12. Design, Simulate and Extract the layout ofa CMOS Inverter

Requirements for Part II : Cadence/Synopsis/ Mentor Graphics/Tanner/equivalent EDA Tools

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Write HDL code for basic as well as advanced digital integrated circuit
2. Import the logic modules into FPGA Boards
3. Synthesize Place and Route the digital IPs
4. Design, Simulate and Extract the layouts of Digital & Analog IC Blocks using EDA tools

		L	T	P	R	C
191ECC701T	**OPTICAL COMMUNICATION AND NETWORKS**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To study about the various optical fiber modes and configuration.
- To understand the transmission characteristics of optical fibers.
- To learn about the various optical sources and detectors.
- To explore various idea about optical fiber measurements and various coupling techniques
- To enrich the knowledge about optical amplifiers and networks

UNIT I : INTRODUCTION TO OPTICAL FIBERS 9

Evolution of fiber optic system- Element of an Optical Fiber Transmission link-- Total internal reflection-Acceptance angle – Numerical aperture – Skew rays Ray Optics-Optical Fiber Modes and Configurations -Mode theory of Circular Wave guides- Overview of Modes-Single Mode Fibers-Graded Index fiber structure.

UNIT II : SIGNAL DEGRADATION OPTICAL FIBERS 9

Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination -Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers- Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling.

UNIT III : OPTICAL SOURCES AND DETECTORS 9

Direct and indirect Band gap materials - Light source materials - LED's- double hetero junction structure, LASER diodes-Modes and Threshold condition -Rate equations- Quantum efficiency, Photo detectors, Photo detector noise, Response time, comparison of photo detectors.

UNIT IV : OPTICAL RECEIVER, MEASUREMENTS AND COUPLING 9

Fundamental receiver operation – Digital receiver performance-Fiber Attenuation measurements- Dispersion measurements – Fiber Refractive index profile measurements – Fiber cut- off Wave length Measurements – Fiber Numerical Aperture Measurements – Fiber diameter measurements- Power Launching and coupling, Lensing schemes, Fiber -to- Fiber joints, Fiber splicing-fiber connectors and fiber couplers.

UNIT V : OPTICAL AMPLIFIERS AND NETWORKS 9

Optical amplifiers: Basic applications - Semiconductor optical amplifiers, EDFA, Optical Networks: Network concepts- topologies - SONET / SDH – Broadcast – and –select WDM Networks -Ultra High Capacity Networks

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Discuss the various optical fiber modes, configurations and various signal degradation factors associated with optical fiber.
2. Understand the various optical sources and optical detectors and their use in the optical communication system.
3. Analyze the digital transmission and its associated parameters on system performance.

TEXT BOOKS:

1. Gerd Keiser, "Optical Fiber Communication" Mc Graw -Hill International, 4th Edition., 2010.
2. John M. Senior, “Optical Fiber Communication”, Second Edition, Pearson Education, 2007.

REFERENCE BOOKS:

1. Gower J., "Optical Communication System", Prentice Hall of India,
2. Ramaswami, Sivarajan and Sasaki “Optical Networks”, Morgan Kaufmann, 2009.
3. Senior J., "Optical Communication, Principles and Practice", Prentice Hall of India, 3rd Edition, 2008.

E-BOOKS / WEB REFERENCES:

1. https://www.youtube.com/watch?v=fnIebfgEgW8
2. http://www.iitg.ac.in/psm/qip2015/material/Subir_Bandyopadhyay_Lecture1.pdf
3. http://www.cesarkallas.net/arquivos/faculdade-pos/TP319-redes-opticas/Optical-Networks-3nd.pdf
4. http://sv.20file.org/up1/169_1.pdf

191ECC711L	ADVANCED COMMUNICATION LABORATORY	L	T	P	R	C
		0	0	4	0	2

PREREQUISITES: NIL

COURSE OBJECTIVES:

- Understand the working principle of optical sources, detector, fibers
- Develop understanding of simple optical communication link
- 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

LIST OF EXPERIMENTS

LIST OF OPTICAL EXPERIMENTS

1. Fiber optic Analog and Digital Link Characterization - frequency response (analog), eye diagram and BER (digital).
2. Measurement of connector, bending and fiber attenuation losses.
3. DC Characteristics of LED.
4. PIN Photo diode characteristics.

LIST OF WIRELESS COMMUNICATION EXPERIMENTS

5. Wireless Channel Simulation including fading and Doppler effects.
6. Simulation of Channel Estimation, Synchronization & Equalization techniques.
7. Analyzing Impact of Pulse Shaping and Matched Filtering using Software Defined Radios.
8. OFDM Signal Transmission and Reception using Software Defined Radios

LIST OF MICROWAVE EXPERIMENTS

9. Gunn Diode and Reflex Klystron Characteristics.
10. VSWR / Impedance Measurement.
11. Characterization of Directional Couplers, Ferrite devices.
12. Radiation Pattern of Horn antenna.

TOTAL PERIODS: 60 HOURS

COURSE OUTCOMES:

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

1. Analyze the performance of simple optical link by measurement of losses and Analyzing the mode characteristics of fiber
2. Analyze the Eye Pattern, Pulse broadening of optical fiber and the impact on BER
3. Estimate the Wireless Channel Characteristics and Analyze the performance of Wireless Communication System
4. Understand the intricacies in Microwave System design

PROFESSIONAL ELECTIVES

		L	T	P	R	C
191ECE501T	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To understand the fundamentals of EMI/EMC.
- To instill knowledge on the EMI coupling mechanism and its mitigation techniques.
- To know and identify suitable EMC standards for various products.
- To impart comprehensive insight about various measurement techniques and instrumentations.

UNIT I : BASIC THEORY **9**

Introduction to EMI and EMC, Intra and inter system EMI, Elements of Interference, Sources and Victims of EMI, Conducted and Radiated EMI emission and susceptibility, Radiation hazards, EMC Testing categories, Units of parameters, Various issues of EMC and Engineering Application.

UNIT II : COUPLING MECHANISM **9**

Coupling and mechanism, Coupling via the supply network, Common mode coupling, Differential mode coupling, Methods of noise coupling, Inductive and Capacitive coupling, Radiative coupling, Ground loop coupling, Cable related emissions and coupling, Transient sources, Automotive transients.

UNIT III : EMI MITIGATION TECHNIQUES **10**

Shielding and working principle of Shielding ,Murphy's Law, Shielding effectiveness, Choice of Materials for H, E, and free space fields, Shielding integrity at discontinuities, PCB Level shielding, EMC Gaskets, Grounding principles and practices, Precautions in earthing, System grounding for EMC, Grounding strategies for Large and mixed signal systems, Filter types and operation, Transient and surge suppression devices.

UNIT IV : STANDARDS AND TEST METHODS 8

Need for Standards, Standards and measurements, Standards for residential and industrial needs, Basic Standards, Product Standards, National and International EMI Standardizing Organizations: IEC, ANSI, FCC, VDE, CISPR, BSI, CENELEC, Euro Norms, MIL STD - 461/462, MIL -STD test methods, Civilian STD test methods.

UNIT V : EMI MEASUREMENTS AND INSTRUMENTATION 9

Fundamental considerations, EMI Shielding effectiveness tests, Open Area test, TEM cell for immunity test, Shielded anechoic chamber, EMI test receivers, Spectrum analyzer, EMI test wave simulators, EMI coupling networks, Line impedance stabilization networks, Feed through capacitors, Antennas, Current probes.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Identify the EMC requirements for the electronic systems.
2. Analyze the mode and type of coupling of EMI signal into and out of the device.
3. Find solution to EMI Sources, EMI problems in PCB level / Subsystem and system level design.
4. Measure emission immunity level from different systems to couple with the prescribed EMC standards
5. Test the EMI environment with suitable measuring apparatus and able to identify the appropriate solution to mitigate the effect of EMI in order to achieve EMC.

TEXT BOOKS:

1. Clayton Paul, “Introduction to Electromagnetic Compatibility”, Wiley Interscience, 2006.
2. Prasad Kodali V, “Engineering Electromagnetic Compatibility”, IEEE Press, New York, 2001.

REFERENCE BOOKS:

1. Daryl Gerke and William Kimmel, “EDN‟s Designer‟s Guide to Electromagnetic Compatibility”, Elsevier Science & Technology Books, 2002
2. Henry W. Otto, “Electromagnetic Compatibility Engineering”, John Wiley & Sons Inc, Newyork
3. Kenneth L Kaiser, “The Electromagnetic Compatibility Handbook”, CRC Press 2005,
4. Scott Bennett, “Control and Measurement of Unintentional Electromagnetic Radiation”, John Wiley & Sons Inc., (Wiley Interscience Series) 1997

E-BOOKS / WEB REFERENCES:

1. http://nptel.ac.in/courses/108106138/
2. http://www.sameer.gov.in/emi-emc-calibration.asp

191ECE502T	ROBOTICS AND AUTOMATION	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To understand the basic concepts associated with the design, functioning, applications and social aspects of robots.
- To study about the electrical drive systems and sensors used in robotics for various applications.
- To learn about analyzing robot kinematics, dynamics through different methodologies and study various design aspects of robot arm manipulator and end-effector.
- To learn about various motion planning techniques and the associated control architecture.
- To understand the implications of AI and other trending concepts of robotics.

UNIT I : FOUNDATION FOR BEGINNERS **9**

Introduction -- brief history, definition, anatomy, types, classification, specification and need based applications; role and need of robots for

the immediate problems of the society, future of mankind and automation-ethical issues; industrial scenario local and global, case studies on mobile robot research platform and industrial serial arm manipulator

UNIT II : BUILDING BLOCKS OF A ROBOT 9

Types of electric motors - DC, Servo, Stepper; specification, drives for motors - speed & direction control and circuitry, Selection criterion for actuators, direct drives, non-traditional actuators; Sensors for localization, navigation, obstacle avoidance and path planning in known and unknown environments – optical, inertial, thermal, chemical, biosensor, other common sensors; Case study on choice of sensors and actuators for maze solving robot and self driving cars

UNIT III : KINEMATICS, DYNAMICS AND DESIGN OF ROBOTS & END- EFFECTORS 9

Robot kinematics - Geometric approach for 2R, 3R manipulators, homogenous transformation using D-H representation, kinematics of WMR, Lagrangian formulation for 2R robot dynamics; Mechanical design aspects of a 2R manipulator, WMR; End-effector - common types and design case study.

UNIT IV : NAVIGATION, PATH PLANNING AND CONTROL ARCHITECTURE 9

Mapping & Navigation – SLAM, Path planning for serial manipulators; types of control architectures - Cartesian control, Force control and hybrid position/force control, Behaviour based control, application of Neural network, fuzzy logic, optimization algorithms for navigation problems, programming methodologies of a robot

UNIT V : AI AND OTHER RESEARCH TRENDS IN ROBOTICS 9

Application of Machine learning - AI, Expert systems; Tele-robotics and Virtual Reality, Micro & Nanorobots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Explain the concepts of industrial robots in terms of classification, specifications and coordinate systems, along with the need and application of robots & automation.
2. Examine different sensors and actuators for applications like maze solving and self driving cars.
3. Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots.
4. Explain navigation and path planning techniques along with the control architectures adopted for robot motion planning.
5. Describe the impact and progress in AI and other research trends in the field of robotics.

TEXT BOOKS:

1. Roland Siegwart, Illah Reza Nourbakhsh, “Introduction to Autonomous Mobile Robots”, MIT Press, 2011
2. Saeed. B. Niku, “Introduction to Robotics, Analysis, system, Applications”, Pearson educations, 2002

REFERENCE BOOKS:

1. Craig, J. J., “Introduction to Robotics: Mechanics and Control”, 2nd Edition, Addison-Wesley, 1989.
2. Fu K.S., Gonzalez R.C. and Lee C.S.G., “Robotics: Control, Sensing, Vision and Intelligence”, McGraw-Hill, 1987.
3. Padhy N.P.,” Artificial Intelligence and Intelligent Systems”, Oxford University Press, 2005
4. Richard David Klafter, Thomas A. Chmielewski, Michael Negin, “Robotic engineering: An integrated approach”, Prentice Hall, 1989
5. Robin Murphy, “Introduction to AI Robotics”, MIT Press, 2000
6. Ronald C. Arkin, “Behavior-based Robotics”, MIT Press, 1998
7. Stefano Nolfi, Dario Floreano, “Evolutionary Robotics – The Biology, Intelligence and Technology of Self–Organizing Machines” (Intelligent Robotics and Autonomous Agents series), MIT Press, 2004.
8. Wesley E Snyder R, “Industrial Robots-Computer Interfacing and Control”, Prentice Hall International Edition, 1988.

191ECE503T MACHINE LEARNING TECHNIQUES	L	T	P	R	C
	3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To understand the need for machine learning for various problem solving
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To learn the new approaches in machine learning
- To design appropriate machine learning algorithms for problem solving

UNIT I : INTRODUCTION **9**

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search

UNIT II : NEURAL NETWORKS AND GENETIC ALGORITHMS 9

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT III : BAYESIAN AND COMPUTATIONAL LEARNING **9**

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV : INSTANT BASED LEARNING **9**

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning.

UNIT V : ADVANCED LEARNING **9**

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Differentiate between supervised, unsupervised, semi-supervised machine learning approaches
2. Apply specific supervised or unsupervised machine learning algorithm for a particular problem
3. Analyze and suggest the appropriate machine learning approach for the various types of problem
4. Design and make modifications to existing machine learning algorithms to suit an individual application
5. Provide useful case studies on the advanced machine learning algorithms

TEXT BOOKS:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (India) Private Limited, 2013.

REFERENCE BOOKS:

1. Ethem Alpaydin, “Introduction to Machine Learning (Adaptive Computation and Machine Learning)”, The MIT Press 2004.
2. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, CRC Press, 2009

		L	T	P	R	C
191ECE504T	**MEDICAL ELECTRONICS**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording

and also the method of transmitting these parameters

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

UNIT I : ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9

Sources of bio medical signals, Bio-potentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, 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, Endomicroscopy, Brain machine interface, Lab on a chip.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Know the human body electro- physiological parameters and recording of bio-potentials
2. Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.

3. Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators
4. Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies , and bio-telemetry principles and methods
5. Know about recent trends in medical instrumentation

TEXT BOOKS:

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TATA Mc Graw-Hill, New Delhi, 2003.

REFERENCE BOOKS:

1. John G.Webster, "Medical Instrumentation Application and Design", 3rd Edition, Wiley India Edition, 2007
2. Joseph J.Carr and John M.Brown, "Introduction to Biomedical Equipment Technology", John Wiley and Sons, New York, 2004.
3. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.

191CSE521T JAVA PROGRAMMING

L	T	P	R	C
3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

UNIT I : INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 9

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- Characteristics of Java –

The Java Environment - Java Source File - Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods - Access specifiers - static members - Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

UNIT II : INHERITANCE AND INTERFACES 9

Inheritance – Super classes - sub classes – Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, extending interfaces - Differences between classes and interfaces - Object cloning - Inner classes, Array Lists – Strings

UNIT III : EXCEPTION HANDLING AND I/O 9

Exceptions - exception hierarchy - throwing and catching exceptions – Built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

UNIT IV : MULTITHREADING AND GENERIC PROGRAMMING 9

Differences between multi-threading and multitasking - Thread life cycle - Creating threads - Synchronizing threads - Inter-thread communication - Daemon threads - Thread groups. Generic Programming – Generic classes – Generic methods – Bounded Types – Restrictions and Limitations.

UNIT V : EVENT DRIVEN PROGRAMMING 9

Graphics programming - Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons - Check Boxes – Radio Buttons – Lists - choices- Scrollbars – Windows –Menus – Dialog Boxes.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Develop Java programs using OOP principles
2. Develop Java programs with the concepts inheritance and interfaces
3. Build Java applications using exceptions and I/O streams
4. Develop Java applications with threads and generics classes
5. Develop interactive Java programs using swings

TEXT BOOKS:

1. Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 9th Edition, Prentice Hall, 2013.
2. Herbert Schildt, “Java The complete reference”, 8th Edition, McGraw Hill Education, 2011.

REFERENCE BOOKS:

1. Danny Poo, Derek Kiong, Swarnalatha Ashok, “Object-Oriented Programming and Java”, 2nd Edition, Springer Publication, 2008.
2. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
3. Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011.
4. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.

191ECE601T	NANOSCIENCE AND TECHNOLOGY	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To provide a broad view of the nascent field of nanoscience and nanotechnology to undergraduates
- To explore the basics of nanomaterial synthesis and characterization.
- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I : INTRODUCTION **9**

Basic Structure of Nanoparticles- Kinetics in Nanostructured Materials- Zero dimensional, size and shape of nanoparticles; one-dimensional and two dimensional nanostructures. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties

UNIT II : BASIC SYNTHESIS TECHNIQUES **9**

Fabrication methods: Top-down processes: Milling-Lithographic process-Machining Bottom-up processes: Vapour phase deposition methods- Plasma-assisted deposition processes- MBE and MOVPE-Liquid phase methods- Colloidal methods- Sol–gel methods-Electrodeposition. Methods for templating the growth of nanomaterials- Ordering of nanosystems- Self-assembly and self-organization- Preparation, Safety and Storage Issues

UNIT III : CHARACTERIZATION TECHNIQUES **9**

Electron Microscopy - SEM, TEM, STEM, Scanning Probe Techniques: STM, AFM, SNOM. Diffraction Techniques, Surface analysis and depth profiling

UNIT IV : NANO STRUCTURES **9**

Carbon Nanotubes- Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT), Applications of Carbon Nanotubes, Fullerenes, Quantum wires, Quantum dots-preparation, properties and applications.

UNIT V : APPLICATIONS **9**

Nano electronics, Nano sensors, Nanotechnology in Diagnostics applications, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Environmental and Agricultural Applications of nanotechnology, Nano technology for energy systems

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Describe the basic science and properties of nanomaterials
2. Interpret the creation, characterization, and manipulation of nanoscale materials.
3. Comprehend the exciting applications of nanotechnology at the leading edge of scientific research.

TEXT BOOKS:

1. Kelsall, Robert W., Ian W. Hamley, and Mark Geoghegan, eds, “Nanoscale Science and Technology”. Chichester, Wiley, 2005.
2. Springer Handbook of Nanotechnology by Bharat Bhushan 2004.

REFERENCE BOOKS:

1. Edelstein A.S. and Cammearata R.C., eds., ”Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. John Dinardo N, “Nanoscale Characterization of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000
3. Timp G, “Nanotechnology”, AIP press/Springer, 1999.

E-BOOKS / WEB REFERENCES:

1. Encyclopedia of Nanotechnology - Hari Singh Nalwa 2004

191ECE602T	**DSP ARCHITECTURE AND PROGRAMMING**	**L**	**T**	**P**	**R**	**C**
		3	**0**	**0**	**0**	**3**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- Basics on Digital Signal Processors
- Programmable DSP‘s Architecture, On-chip Peripherals and Instruction set
- Programming for signal processing applications

- Advanced Programmable DSP Processors

UNIT I : FUNDAMENTALS OF PROGRAMMABLE DSPs 9

Introduction to Programmable DSPs, Architectural Features of PDSPs - Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals, Applications of Programmable DSPs

UNIT II : TMS320C5X PROCESSOR 9

Architecture of C5X Processor – Addressing modes – Assembly language Instructions - Pipeline structure, On-chip Peripherals – Block Diagram of DSP starter kit (DSK) – Software Tools, DSK on-board peripherals, Application Programs for processing real time signals.

UNIT III : TMS320C6X PROCESSOR 9

Architecture of the C6x Processor - Instruction Set – Addressing modes, Assembler directives, Onchip peripherals, DSP Development System: DSP Starter Kit - Code Composer Studio - Support Files – Introduction to AIC23 codec and other on-board peripherals, Real-Time Programming Examples

UNIT IV : ADSP PROCESSORS 9

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs.

UNIT V : ADVANCED PROCESSORS 9

Study of TI‘s advanced processors - TMS320C674x and TMS320C55x DSPs, ADSP‘s Blackfin and Sigma DSP Processors, NXP‘s DSP56Fxx Family of DSP Processors, Comparison of the features of TI, ADSP and NXP DSP family processors.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Analyze the concepts of Digital Signal Processors
2. Demonstrate their ability to program the DSP processor for signal processing applications
3. Discuss, compare and select the suitable Advanced DSP Processors for real-time signal processing applications

TEXT BOOKS:

1. Venkataramani B. and Bhaskar M., "Digital Signal Processors – Architecture, Programming and Applications" Tata McGraw Hill Publishing Company Limited. New Delhi, 2003.

REFERENCE BOOKS:

1. Avtar Singh and S. Srinivasan, "Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx", Cengage Learning India Private Limited, Delhi 2012
2. Rulph Chassaing and Donald Reay, "Digital Signal Processing and Applications with the C6713 and C6416 DSK", John Wiley & Sons, Inc., Publication, 2012 (Reprint).

E-BOOKS / WEB REFERENCES:

1. User guides Texas Instruments, Analog Devices and NXP

191ECE603T	**DIGITAL IMAGE PROCESSING**	**L**	**T**	**P**	**R**	**C**
		3	**0**	**0**	**0**	**3**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- Understand the digital image fundamentals.
- Analyze the image enhancement techniques.
- Understand the image restoration techniques.
- Familiarize the image compression techniques
- Understand the image segmentation and representation techniques.

UNIT I : DIGITAL IMAGE FUNDAMENTALS 9

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – color fundamentals and models.

UNIT II : IMAGE ENHANCEMENT 9

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

UNIT III : IMAGE RESTORATION 9

Introduction to degradation-Types of image degradations-Image degradation model- Noise models – Mean Filters – Order Statistics Filters– Band reject Filters – Band pass Filters – Notch Filters – Image Restoration Technique - Inverse Filtering – Wiener filtering –- Blind Image Restoration. Morphological processing- erosion and dilation.

UNIT IV : IMAGE COMPRESSION 9

Compression: Fundamentals – Image Compression models – Lossless Compression Algorithms - Lossless Predictive Coding – Lossy Compression Algorithms- Lossy Predictive Coding -Block Transform Coding – Compression Standards: JPEG – JPEG 2000-MPEG

UNIT V : IMAGE SEGMENTATION AND REPRESENTATION 9

Segmentation: Detection of Discontinuities–Point, Line and Edge detection- Gradient operators- Thresholding – Region based segmentation- Boundary Representation Schemes – Chain Code – Polygonal approximation, signatures – Boundary descriptors – Basic boundary descriptors - Shape number – Regional Descriptors-Patterns and Pattern classes – Recognition based on matching

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Discuss digital image fundamentals.
2. Apply image enhancement techniques.
3. Apply image restoration techniques
4. Apply image compression Techniques.
5. Learn Image Segmentation and represent features of images

TEXT BOOKS:

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010

REFERENCE BOOKS:

1. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.
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. S.Sridhar, “Digital Image Processing”, Second Edition, Oxford University Press, 2016..
4. Willliam K Pratt, “Digital Image Processing”, John Willey, 2002.

191CSE621T	COMPUTER ARCHITECTURE AND ORGANIZATION	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE 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

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 OPERATIONS 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 PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Describe data representation, instruction formats and the operation of a digital computer
2. Illustrate the fixed point and floating-point arithmetic for ALU operation
3. Discuss about implementation schemes of control unit and pipeline performance
4. Explain the concept of various memories, interfacing and organization of multiple processors
5. Discuss parallel processing technique and unconventional architectures

TEXT BOOKS:

1. David A. Patterson and John L. Hennessey, “Computer Organization and Design”, Fifth edition, Morgan Kauffman / Elsevier, 2014. (UNIT I-V)
2. Miles J. Murdocca and Vincent P. Heuring, “Computer Architecture and Organization: An Integrated approach”, Second edition, Wiley India Pvt Ltd, 2015 (UNIT IV,V)

REFERENCE BOOKS:

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

191CSE622T	ARTIFICIAL INTELLIGENCE	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE 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 planning in software agents
- To know about the various expert systems of AI.

UNIT I : INTRODUCTION TO AI AND PRODUCTION SYSTEMS 9

Introduction–Definition–Future of Artificial Intelligence-Characteristics of Intelligent agents-Typical intelligent agents-Problem Solving Approach to Typical AI problems-Production systems-Production systems characteristics.

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 AND INFERENCE 9

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Reasoning Systems for Categories -Reasoning with Default Information- Rule value approach, Fuzzy reasoning – Rule value approach– Certainty factors, Bayesian Theory-Bayesian Network.

UNIT IV : PLANNING AND MACHINE LEARNING 9

Planning Problem –STRIPS- Planning and acting in the real world-Learning -Learning Decision trees-Support Vector Machines-Ensemble Learning -Practical Machine Learning.

UNIT V : EXPERT SYSTEM 9

Expert systems Knowledge acquisition concepts – AI application to robotics – Current trends in Intelligent Systems-Typical expert systems - MYCIN, DART, Expert systems shells.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Students can able to identify problems that are amenable to solution by AI methods.
2. Able to identify appropriate AI methods to solve a given problem in representation of knowledge.
3. Able to formalize a given problem in the language/framework of different AI methods.
4. Students can able to implement basic AI algorithms to solve a given problem in planning and machine learning by AI methods.
5. Able to design and carry out an empirical evaluation of different algorithms on a problem formalization and to gain knowledge about various expert systems

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill- 2008.
2. Tim Jones, “Artificial Intelligence: A Systems Approach(Computer Science)”, Jones and Bartlett Publishers, Inc.; First Edition, 2008
3. William F. Clocksin and Christopher S. Mellish,” Programming in Prolog: Using the ISO Standard”, Fifth Edition, Springer, 2003.

191ECE701T	SATELLITE COMMUNICATION	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE 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.

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, Attitude and Orbit control, Thermal control and Propulsion, Communication Payload and supporting subsystems, Telemetry, Tracking and Command subsystem – Transponders - The Antenna subsystem

UNIT III : SATELLITE LINK DESIGN **9**

Basic link analysis, Link-power budget equation, 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 PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Analyze the satellite orbits
2. Analyze the earth segment and space segment
3. Analyze the satellite Link design
4. Design various satellite applications

TEXT BOOKS:

1. Dennis Roddy, “Satellite Communication”, 4th Edition, Mc Graw Hill International, 2006.
2. Timothy,Pratt,Charles,W.Bostain,JeremyE.Allnutt,"SatelliteCommunication”,2nd Edition, Wiley Publications,2002

REFERENCE BOOKS:

1. Agarwal.N “Design of Geosynchronous Space Craft”, Prentice Hall, 1986.
2. Bruce R. Elbert, “The Satellite Communication Applications”, Hand Book+, Artech House Bostan London, 1997.
3. Richharia M., “Satellite Communication Systems-Design Principles”, Macmillan 2003.
4. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, “Satellite Communication Systems Engineering”, Prentice Hall/Pearson, 2007.

191ECE702T	COMMUNICATION NETWORKS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE 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

UNIT I : FUNDAMENTALS & PHYSICAL LAYER 7

Overview of Data Communications- Networks – Building Network and its types– Overview of Internet Protocol Layering - OSI Model - Physical Layer - Guided and Unguided Transmission media- Switching: Circuit switched networks – Datagram Networks – Virtual circuit networks

UNIT II : DATA LINK LAYER 10

Data Link layer Services - Framing - Error Detection and Error Correction - Flow control- Switching and bridging – Bit oriented protocols-Byte oriented protocols- Overview of Data link Control and Media access control - Ethernet (802.3) - Wireless LANs – Bluetooth

UNIT III : NETWORK LAYER 10

Network layer services – Packet Switching – IPV4 Address – Network layer protocols (IP, ICMP, ARP, RARP) -Routing - Unicast Routing – Algorithms – Protocols – Multicast Routing and its basics – Intradomain and interdomain protocols – Overview of IPv6 Addressing

UNIT IV : TRANSPORT LAYER 9

Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management - Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements

UNIT V : APPLICATION LAYER 9

Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP Network Security – Firewalls

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Enumerate the layers of the OSI model and TCP/IP and identify the components required to build different types of networks

2. Evaluate data communication link considering elementary concepts of data link layer protocols for error detection and correction
3. Apply various network layer techniques for designing subnets and supernets and analyse packet flow on basis of routing protocols
4. Estimate the congestion control mechanism to improve quality of service of networking application
5. Understand and design application layer protocols and internet applications
6. Familiarity with the basic protocols of communication networks(layer-wise), and how they can be usedto assist in network design and implementation

TEXT BOOKS:

1. Behrouz A. Forouzan, " Data communication and Networking", Fifth Edition, Tata McGraw – Hill, 2013.(UNIT I –III)
2. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011. (UNIT IV-V)

REFERENCE BOOKS:

1. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", Seventh Edition, Pearson Education, 2016.
2. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.
3. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2nd Edition, 2014.
4. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", Mc Graw Hill Publisher, 2011.

E-BOOKS / WEB REFERENCES:

1. nptel.ac.in/courses/106/105/106105183/

191ECE703T	WIRELESS COMMUNICATION	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To study the characteristic of wireless channel
- To understand the design of a cellular system
- To study the various digital signaling techniques and multipath mitigation techniques
- To understand the concepts of multiple antenna techniques

UNIT I : WIRELESS CHANNELS **9**

Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – 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 II : CELLULAR ARCHITECTURE AND MULTIPLE ACCESS TECHNIQUES **9**

Cellular concept -Capacity calculations– Frequency reuse - channel assignment- hand off- interference & system capacity trunking & grade of service – Coverage and capacity improvement-repeaters-Multiple Access techniques - FDMA, TDMA, CDMA.

UNIT III : DIGITAL SIGNALING FOR FADING CHANNELS **9**

Structure of a wireless communication link, Principles of Offset-QPSK, pi/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix.

UNIT IV : MULTIPATH MITIGATION TECHNIQUES **9**

Equalization – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

UNIT V : MULTIPLE ANTENNA TECHNIQUES 9

MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Characterize a wireless channel and evolve the system design specifications.
2. Design a cellular system based on resource availability and traffic demands
3. Identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration.

TEXT BOOKS:

1. Andreas.F. Molisch, “Wireless Communications”, John Wiley – India, 2006. (UNIT III,V)
2. Rappaport,T.S., “Wireless communications”, Pearson Education, Second Edition, 2010.(UNIT I, II, IV)

REFERENCE BOOKS:

1. Andrea Goldsmith , “Wireless Communication”, Cambridge University Press, 2011
2. David Tse and PramodViswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
3. Upena Dalal, “Wireless Communication”, Oxford University Press, 2009.
4. Van Nee, R. and Ramji Prasad, “OFDM for wireless multimedia communications”, Artech House, 2000

191ECE704T	LOW POWER VLSI DESIGN	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- The student will get to know the basic sources of power dissipation.
- Identify the various power optimization techniques at various design levels.
- Know the techniques of low power mechanisms memories and layout design.
- Knowledge on power estimation
- Software synthesis for low power

UNIT I : POWER DISSIPATION IN CMOS **9**

Sources of power consumption – Physics of power dissipation in CMOS FET devices – Basic principle of low power design

UNIT II : POWER OPTIMIZATION **9**

Logic level power optimization – Circuit level low power design – circuit techniques for reducing power consumption in adders.

UNIT III : DESIGN OF LOW POWER CMOS CIRCUITS **9**

Computer arithmetic techniques for low power system – reducing power consumption in memories – low power clock, Inter connect and layout design.

UNIT IV : POWER ESTIMATION **9**

Power Estimation techniques – logic power estimation – Simulation power analysis –Probabilistic power analysis.

UNIT V : SYNTHESIS AND SOFTWARE DESIGN FOR LOW POWER **9**

Synthesis for low power – Behavioral level transform – software design for low power.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Identify sources of power in a CMOS IC.
2. Identify the power reduction techniques based on technology independent and technology dependent
3. Power dissipation mechanism in various MOS logic style.
4. Identify suitable techniques to reduce the power dissipation.
5. Design memory circuits with low power dissipation.

TEXT BOOKS:

1. Gary Yeap, “Practical low power digital VLSI design”, Kluwer, 1998.
2. Kaushik Roy and S.C.Prasad, “Low power CMOS VLSI circuit design”, Wiley, 2000.

REFERENCE BOOKS:

1. Abdelatif Belaouar, Mohamed.I.Elmasry, “Low power digital VLSI design”, Kluwer, 1995
2. Chandrasekaran A.P and R.W.Broadersen, “Low power digital CMOS design”, Kluwer,1995.
3. Dimitrios Soudris, Chirstian Pignet, Costas Goutis, “Designing CMOS Circuits for Low Power”, Kluwer, 2002.
4. James B.Kulo, Shih-Chia Lin, “Low voltage SOI CMOS VLSI devices and Circuits”, John Wiley and sons, inc. 2001.

191MBE721T	PRINCIPLES OF MANAGEMENT AND PSYCHOLOGY	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To enable the students to learn the functions Management, and its application in an organization.
- To learn the application of psychology in human behaviour for the benefit of organization

UNIT : INTRODUCTION TO MANAGEMENT & PLANNING 9

Definition of Management -managerial roles and skills – Evolution of Management – Scientific, human relations, system and contingency approaches - Current trends and issues in Management. Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Decision making steps and process.

UNIT II : ORGANIZING & STAFFING 9

Nature and purpose – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization. Human Resource Management –Recruitment, selection, Training and Development, Performance Management.

UNIT III : DIRECTING & CONTROLLING 9

Motivation – motivation theories – motivational techniques - leadership – types and theories of leadership Communication – process of communication – barrier in communication. Controlling -importance and process of controlling – budgetary and non-budgetary control techniques – Productivity problems and management.

UNIT IV : INTRODUCTION TO PSYCHOLOGY 9

Definition of Psychology-- Evolution of psychology - Social Perception – Conscious Clarity – Determinants of Attention – Distraction – Training Attention.

UNIT V : ATTITUDES AND HUMAN BEHAVIOR 9

Attitudes and Human Behavior- Nature and Functions of Attitudes - Formation of Attitudes- Attitudes Influence Behavior - Persuasion - Process of Changing Attitudes - Traditional and Cognitive approaches - Other factors affecting Persuasion - Resistance to Changing Attitudes - Reactance - Forewarning - Selective avoidance.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Have clear understanding of Managerial functions.
2. Learn the basic methods of psychology and to learn the practical problems and work of Psychologists

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Harold Koontz & Heinz Weihrich,” Essentials of management” Tata McGraw Hill,1998.
2. Marx, Melvin H. “Introduction to Psychology – Problems, Procedures & Principles”, MacMillan Publishing Co, 1976.
3. Morgan, Clifford.T., King, Richard.A., Weisz John,R., Schopler, John (1993),“Introduction to Psychology”, Tata McGraw Hill.
4. Robert Kreitner& Mamata Mohapatra, “Management”, Biztantra, 2008.
5. Stephen A. Robbins & David A. Decenzo& Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011.
6. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999

191ECE711T	AD HOC AND SENSOR NETWORKS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE 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

- Learn the architecture and protocols of wireless sensor 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 : WSN ROUTING, LOCALIZATION & QOS 9

Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QoS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Know the basics of Ad hoc networks and Wireless Sensor Network.
2. Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement.
3. Apply the knowledge to identify appropriate physical and MAC layer protocols.
4. Understand the transport layer and security issues possible in Ad hoc and sensor networks.
5. Evaluate the QoS related performance measurements of ad hoc and sensor networks

TEXT BOOKS:

1. Holger Karl, Andreas willig, “Protocol and Architecture for Wireless Sensor Networks”, John wiley publication, Jan 2006. (Unit 2,3 & 4)

2. Siva Ram Murthy C, and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols“, Prentice Hall Professional Technical Reference, 2004.(Unit 1 & 5)

REFERENCE BOOKS:

1. Akyildiz I.F., Sankarasubramaniam W. Su, Cayirci E., “Wireless sensor networks: a survey”, computer networks, Elsevier, 2002, 394 - 422.
2. Charles E. Perkins, “Ad Hoc Networking”, Addison Wesley, 2000.
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks: an information processing approach”, Elsevier publication, 2004.

191ECE712T ADVANCED EMBEDDED SYSTEMS	L	T	P	R	C
	3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- Learn the architecture and programming of ARM processor.
- Be familiar with the embedded computing platform design and analysis.
- Be exposed to the basic concepts of real time Operating system.
- Learn the system design techniques and networks for embedded systems

UNIT I : INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS 9

Complex systems and microprocessors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output-supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

UNIT II : EMBEDDED COMPUTING PLATFORM DESIGN 9

CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis - Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

UNIT III : PROCESSES AND OPERATING SYSTEMS 9

Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE.

UNIT IV : SYSTEM DESIGN TECHNIQUES AND NETWORKS 9

Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems – MPSoCs and shared memory multiprocessors.

UNIT V : CASE STUDY 9

Compressor - Audio player - Software modem-Digital still camera - Telephone answering machine-Engine control unit – Video accelerator.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Describe the architecture and programming of ARM processor.
2. Outline the concepts of embedded systems
3. Explain the basic concepts of real time Operating system design.
4. Use the system design techniques to develop software for embedded systems
5. Differentiate between the general purpose operating system and the real time operating system
6. Model real-time applications using embedded-system concepts

TEXT BOOKS:

1. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, Third Edition Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.

REFERENCE BOOKS:

1. David. E. Simon, “An Embedded Software Primer”, 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.
2. Jonathan W.Valvano, “Embedded Microcomputer Systems Real Time Interfacing”, Third Edition Cengage Learning, 2012.

3. Krishna C.M., Kang G. Shin, "Real-Time Systems", International Editions, Mc Graw Hill 1997
4. Raymond J.A. Buhr, Donald L.Bailey, "An Introduction to Real-Time Systems- From Design to Networking with C/C++", Prentice Hall, 1999.
5. Sriram V Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", Tata Mc Graw Hill, 2004.

191ECE713T	PHOTONIC NETWORKS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To understand the importance of the backbone infrastructure for our present and future communication needs and familiarize them with the architectures and the protocol stack in use
- To enable the student to understand the differences in the design of data plane and the control plane and the routing, switching and the resource allocation methods and the network management and protection methods in vogue
- To expose the student to the advances in networking and switching domains and the future trends

UNIT I : PHOTONIC MATERIAL **9**

Optical processes in semiconductors - Quantum well structures - quantum confined Stark effect - Semiconducting polymers - Quantum well lasers - liquid crystals – photoluminescence – electroluminescence - Second and third order optical materials - Photorefractive materials.

UNIT II : OPTICAL SYSTEM COMPONENTS **9**

Light Propagation in optical fibers – Loss & bandwidth - System limitations - Nonlinear effects - Solitons - Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters - Optical Amplifiers – Switches - Wavelength Converters.

UNIT III : PHOTONICS DEVICES 9

Non-linear optics – Modulators - Film growth and deposition - defects and strain - Fabrication technology for photonics - III-V semiconductor device technology and processing -silicon photonics technology - photonic integrated circuit in telecommunication and sensors.

UNIT IV : PHOTONICS WIRELESS LINKS 9

Introduction - Approaches for Photonic Millimeter and Sub-Millimeter Wave Sources - Millimeter-Wave and Sub-Millimeter Wave Photonic Transmitters - Photonic MMW Wireless Links - Fiber Bragg Gratings for Microwave Photonics Applications.

UNIT V : PHOTONIC SYNTHESIS AND APPLICATION9

Introduction - Arbitrary Millimeter Waveform Synthesis – Ultra broadband Microwave Waveform Synthesis - Application of Ultrafast Optoelectronics and Monolithic Distributed Microwave Photonic Devices -Introduction - Lightwave Switching in Semiconductor Micro ring Devices by Free-Carrier Injection -Polarization Switching Dynamics of Thin-Film Ferroelectric Capacitors - Balanced Coherent Detection Using Polymer Optical Waveguide Integrated Distributed Traveling-Wave Photodetector.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Explain the basic concepts of Microwave photonic systems and their applications.
2. Describe the concepts of photonic wireless links
3. Show the knowledge in hybrid fiber radio concepts and switching concepts
4. Discuss about photonics synthesis and applications.

TEXT BOOKS:

1. Green, Jr., “Fiber Optic Networks”, Prentice Hall, NJ, 1993.

2. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks: A Practical Perspective”, Harcourt Asia Pvt Ltd., Second Edition 2004

REFERENCE BOOKS:

1. Chi H. Lee., “Microwave Photonics”, 2nd Edition, CRC press (2013).
2. Stavros Iezekiel ., “ Microwave Photonics Devices And Applications” John Wiley &Sons, Inc., 2009
3. Vincent J. Urick Jr., Jason D. Mckinney, Keith J. Williams., “Fundamentals of Microwave Photonics”, John Wiley & Sons, Inc., 2015.

191ECE714T CMOS ANALOG IC DESIGN

L	T	P	R	C
3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To study the fundamentals of analog circuits and MOS device models
- To gain knowledge on various configurations of MOS transistors
- To study the frequency response of the amplifier
- To learn the concepts of Op-Amp and stability with frequency compensation

UNIT I : INTRODUCTION TO ANALOG IC DESIGN AND CURRENT MIRRORS **9**

Concepts of Analog Design - General consideration of MOS devices – MOS I/V Characteristics – Second order effects – MOS device models. Basic current mirrors- Cascode current mirrors.

UNIT II : SINGLE STAGE AMPLIFIER **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.

UNIT III : FREQUENCY RESPONSE OF AMPLIFIERS 9

General considerations- Miller Effect and Association of Poles with Nodes, Common source stage- Source followers- Common gate stage- Cascode stage- Differential pair.

UNIT IV : OPERATIONAL AMPLIFIER 9

General Considerations- One and Two Stage Op Amps- Gain Boosting- Comparison- Common mode feedback- Input range limitations- Slew rate- Power Supply Rejection.

UNIT V : STABILITY AND FREQUENCY COMPENSATION 9

General consideration of stability and frequency compensation- Multipole system- Phase margin-Frequency compensation- Compensation of two stage op Amps- Other compensation techniques

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Realize the concepts of Analog MOS devices and current mirror circuits.
2. Design different configuration of Amplifiers.
3. Analyze the characteristics of frequency response of the amplifier.
4. Analyze the performance of the stability and frequency compensation techniques of OpAmp Circuits.

TEXT BOOKS:

1. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, Tata McGraw Hill, 2016

REFERENCE BOOKS:

1. Grebene, “Bipolar and MOS Analog Integrated circuit design”, John Wiley & sons, Inc., 2003

2. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, “Analysis and Design of Analog Integrated Circuits”, 5th Edition, Wiley, 2009
3. Phillip Allen and Douglas Holmberg, “CMOS Analog Circuit Design” Second Edition, Oxford University Press, 2004.

191GEE721T	DISASTER MANAGEMENT	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To provide & gain basic conceptual understanding of disasters and its relationships with development.
- To prevent and control Public Health consequences of Disasters

UNIT I : INTRODUCTION TO DISASTER **9**

Concepts of Hazard, Vulnerability, Risks, Natural Disasters and Man Made Disaster and Rapid Onset Disasters. Risks, Difference between Accidents and Disasters, Simple and Complex Disasters, Refugee problems. Political, Social, Economic impacts of Disasters. Gender and Social issues during disasters, principles of psychosocial issues and recovery during emergency situations, Equity issues in disasters. Relationship between Disasters and Development and vulnerabilities, different stake holders in Disaster Relief.

UNIT II : APPROACHES TO DISASTER RISK REDUCTION **9**

Disaster Risk Reduction Strategies, Disaster Cycle, Phases of Disaster, Preparedness Plans, Action Plans and Procedures, Early warning Systems, Components of Disaster Relief, Community based DRR, Structural, non structural measures in DRR, Factors affecting Vulnerabilities, Mainstreaming disaster risk reduction in development, Undertaking risk and vulnerability assessments, Policies for Disaster Preparedness Programs. Sustainable Management, Survey of Activities during Disasters, DRR Master Planning for the Future. Rehabilitation measures and long term reconstruction.

UNIT III : PRINICPLES OF DISASTER MEDICAL MANAGEMENT 9

Introduction to disaster medicine, Various definitions in disaster medicine, Disaster life cycle, Disaster planning, Disaster preparation. National Assessing the nature of hazardous material - Types of injuries caused, Self protection contaminated area and decontaminated area. Safe patient transportation –Identification of valuable groups - Knowledge about antidotes, - and Body decontaminations – Poly trauma Care - Specific treatment in emergency and Intensive Care Units.

UNIT IV : PUBLIC HEALTH RESPONSE AND INTERNATIONAL COOPERATION 9

Outbreak Investigation Environment health hygiene and sanitation issues during disasters, Preventive and prophylactic measures including Measles immunization, ORS, water, supply, chemoprophylaxis, food fortification, food supplements, MISP-Reproductive Health Care, International cooperation in funding on public health during disaster - International Health Regulations.

UNIT V : DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability Profile India - Disaster Management Act 2005 and Policy guidelines, National Institute of Disaster Management, National Disaster Response Force (NDRF)National Disaster Management Authority, States Disaster Management Authority, District Disaster Management Authority - Mines Safety in India - Cases Studies : Bhopal Gas Disaster, Gujarat Earth Quake.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Differentiate the types of disasters, causes and their impact on environment and society
2. Assess vulnerability and various methods of risk reduction measures as well as mitigation.

3. Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXT BOOKS:

1. Guerisse P, "Basic Principles of Disaster Medical Management". Act Anaesth. Belg;56:395-401, 2005

REFERENCE BOOKS:

1. Satapathy S, "Psychosocial care in Disaster management, A training of trainers manual (ToT"), NIDM publication, 2009.

E-BOOKS / WEB REFERENCES:

1. Aim and Scope of Disaster Management. Study Guide prepared by Sharman and Hansen. UW-DMC, University of Washington.
2. Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction Programme (2009-2012)
3. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003.
4. Sphere Project, Humanitarian Charter and Minimum Standards in Disaster Response , 2011.

191ECE801T	COGNITIVE RADIO AND 5G WIRELESS SYSTEMS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE 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 for cognitive radio

- To expose the student to evolving applications and advanced features of cognitive radio

UNIT I : INTRODUCTION TO SOFTWARE-DEFINED RADIO AND COGNITIVE RADIO 9

Evolution of Software Defined Radio and Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, radio frequency spectrum and regulations.

UNIT II : COGNITIVE RADIO ARCHITECTURE 9

Cognitive Radio – functions, components and design rules, Cognition cycle – orient, plan, decide and act phases, Inference Hierarchy, Architecture maps, Building the Cognitive Radio Architecture on Software defined Radio Architecture, 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 , Bayesian Approach, Neyman Pearson fusion rule for spectrum sensing, Optimum spectrum sensing – KullbackLeibler Divergence and other approaches, Fundamental Tradeoffs in spectrum sensing, Fundamental Limits of Cognitive Radio. Cognitive radio for Internet of Things - Features and applications – Enabling technologies and protocols – M2M technologies

UNIT IV : INTRODUCTION TO ROAD MAP TO 5G 9

Historical trend and evolution of LTE technology to beyond 4G - Key building blocks of 4G - 5G use cases and system concepts – The 5G Architecture - IoT: relation to 5G

UNIT V : 5G APPLICATIONS 9

Machine type communications – Device to device communication – Multi-hop D2D communication – Multi operator D2D Communication – New Challenges in 5G methodology

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Discuss Software defined radio and Cognitive radio
2. Discuss Spectrum access for cognitive radio
3. Discuss cognitive radio for Internet of Things and M2M technologies
4. Discuss on introduction on 5G wireless communication and its applications

TEXT BOOKS:

1. Alexander M. Wyglinski, MaziarNekovee, Thomas Hou, "Cognitive Radio Communications and Networks", Academic Press, Elsevier, 2010.
2. Bruce Fette, "Cognitive Radio Technology", Newnes, 2006.

REFERENCE BOOKS:

1. AfifOsseiran, Jose F. Monserrat and Patrick Marsch, "5G Mobile and Wireless Communications Technology" Cambridge University Press, 2016.
2. HuseyinArslan (Ed.), "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Springer, 2007.
3. Shanmugavel S., Bhagyaveni M.A., Kalidoss R., "Cognitive Radio-An Enabler for Internet of things", River Publishers, 2017
4. Wei Xiang, Kan Zheng, Xuemin (Sherman) Shen, "5G Mobile Communications", Springer, 2017.

		L	T	P	R	C
191ECE802T	**ANALOG AND MIXED MODE SIGNAL IC DESIGN**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- Understand the basic structure and operation of MOSFET and its configurations.
- Study the mixed signal of submicron CMOS circuits
- Understand the various integrated based filters and topologies
- Learn the data converters architecture, modeling and signal to noise ratio

UNIT I : INTRODUCTION AND BASIC MOS DEVICES 9

Challenges in analog design, Mixed signal layout issues. MOS FET structures and characteristics- large signal and small signal model, single stage- common source Amplifier-Source follower- Common gate stage – Cascode Stage .

UNIT II : SUB-MICRON CIRCUIT DESIGN 9

Submicron CMOS process flow, Capacitors and resistors, Current mirrors, Digital Circuit Design, Delay Elements – Adders- OP Amp parameters and Design.

UNIT III : SWITCHED CAPACITOR CIRCUITS 9

Resistors, First order low pass Circuit, Switched capacitor Amplifier, Switched Capacitor Integrator.

UNIT IV : DATA CONVERTER ARCHITECTURE 9

DAC architecture- Resistor string, R-2R ladder network, current steering, charge scaling DACs, Cyclic DAC and Pipeline DAC. ADC architecture- flash, two-step flash ADC, pipeline ADC, Integrating ADC's, Successive approximation ADC.

UNIT V : SNR IN DATA CONVERTERS 9

Overview of SNR of Data Converters- Clock Jitters- Improving Using Averaging – Decimating Filters for ADC- Band pass and High Pass Sinc Filters- Interpolating Filters for DAC.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Student should be able to apply the concepts for mixed signal MOS circuit.
2. Analyze the characteristics of IC based CMOS filters.
3. Design of various data converter architecture circuits.
4. Analyze the signal to noise ratio and modeling of mixed signals.

TEXT BOOKS:

1. Behzad Razavi, "Design of Analog CMOS Integrated

Circuits",Tata McGraw Hill, 2002.

2. Jacob Baker R., “CMOS Mixed Signal Circuit Design”, wiley india, IEEE Press, Reprint 2008.

REFERENCE BOOKS:

1. David Johns, Ken Martin, "Analog Integrated Circuit Design",John Wiley and Sons, 1997.
2. Jacob baker,“CMOS Circuit Design, Layout and Simulation”, wileyindia, IEEE Press, second edition, Reprint 2009.
3. Phillip E. Allen, Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford University Press, 2002.

191ECE803T	**RADAR AND NAVIGATIONAL AIDS**	**L**	**T**	**P**	**R**	**C**
		3	**0**	**0**	**0**	**3**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To apply Doppler principle to radars and hence detect moving targets
- To refresh principles of antennas and propagation as related to radars
- To understand principles of navigation

UNIT I : INTRODUCTION TO RADAR EQUATION 9

Introduction- Basic Radar –The simple form of the Radar Equation- Radar Block Diagram- Radar Frequencies –Applications of Radar – The Origins of Radar - Detection of Signals in Noise- Receiver Noise and the Signal-to-Noise Ratio-Probability Density Functions- Probabilities of Detection and False Alarm- Integration of Radar Pulses- Radar Cross Section of Targets- Radar cross Section Fluctuations- Transmitter Power-Pulse Repetition Frequency

UNIT II : MTI AND PULSE DOPPLER RADAR 9

Introduction to Doppler and MTI Radar- Delay –Line Cancellers- Staggered Pulse Repetition Frequencies –Doppler Filter Banks - Digital MTI Processing - Moving Target Detector - Limitations to MTI Performance - MTI from a Moving Platform (AMIT) – Pulse Doppler Radar – Other Doppler Radar Topics- Tracking with Radar – Monopulse Tracking –Conical Scan and Sequential Lobing - Limitations to Tracking Accuracy - Low-Angle Tracking - Tracking in Range

UNIT III : DETECTION OF SIGNALS IN NOISE 9

Matched –Filter Receiver –Detection Criteria – Detectors –- Automatic Detector - Integrators - Constant-False-Alarm Rate Receivers - Propagation Radar Waves -Propagation over a plane earth - The Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas – Phase Shifters - Frequency-Scan Arrays

Radar Transmitters and Receivers - Introduction–Linear Beam Power Tubes - Solid State RFPower Sources - Magnetron - Crossed Field Amplifiers. The Radar Receiver - Receiver noise Figure – Super heterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.

UNIT IV : RADIO DIRECTION AND RANGES 9

Introduction - Four methods of Navigation .- The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders – The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders

UNIT V : SATELLITE NAVIGATION SYSTEM 9

Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment - Instrument Landing System - Ground Controlled Approach System - Microwave Landing System(MLS) The Doppler Effect - Beam Configurations -Doppler Frequency Equations - Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation - Accuracy of Doppler Navigation Systems.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Explain principles of navigation, in addition to approach and landing aids as related to navigation
2. Derive and discuss the Range equation and the nature of detection.
3. Describe about the navigation systems using the satellite.

TEXT BOOKS:

1. Merrill I. Skolnik ," Introduction to Radar Systems", 3rd Edition Tata Mc Graw-Hill 2003.
2. Nagaraja N.S., “Elements of Electronic Navigation Systems”, 2nd Edition, TMH, 2000.

REFERENCE BOOKS:

1. Peyton Z. Peebles:, "Radar Principles", John Wiley, 2004
2. Toomay J.C, "Principles of Radar", 2nd Edition –PHI, 2004.

E-BOOKS / WEB REFERENCES:

1. nptel.ac.in/courses/108/105/108105154/

191ECE804T	SPEECH PROCESSING AND SYNTHESIS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To understand the speech production mechanism
- To understand the various speech analysis techniques
- To understand the speech compression techniques
- To understand the speech recognition and speaker recognition techniques
- To know the text to speech synthesis techniques

UNIT I : SPEECH SIGNAL CHARACTERISTICS 9

Speech production process - speech sounds and features- - Phonetic Representation of Speech – representing - speech in time and frequency domains - Short-Time Analysis of Speech - Short- Time Energy and Zero-Crossing.

UNIT II : SPEECH SIGNAL ANALYSIS 9

Short-Time Autocorrelation Function - Short-Time Fourier Transform (STFT) - Speech Spectrum - Cepstrum - Mel-Frequency Cepstrum Coefficients - Hearing and Auditory Perception - Perception of Loudness - Critical Bands - Pitch Perception.

UNIT III : SPEECH COMPRESSION 9

Sampling and Quantization of Speech (PCM) - Adaptive differential PCM - Delta Modulation - Vector Quantization- Linear predictive coding (LPC) - Code excited Linear predictive Coding (CELP).

UNIT IV : SPEECH RECOGNITION and SPEAKER RECOGNITION 9

LPC for speech recognition- Hidden Markov Model (HMM) - Overall recognition system based on subword units. Acoustic parameters for speaker verification - Feature space for speaker recognition.

UNIT V : TEXT TO SPEECH SYNTHESIS 9

Text to Speech Synthesis (TTS)-Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness-role of prosody.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Analyze the characteristics of speech signal
2. Analyze the speech signal using various analysis techniques
3. Develop knowledge in speech compression techniques
4. Configure speech recognition techniques
5. Discuss and compare the suitable model for speech recognition system

6. Apply suitable technique for text to speech synthesis systems

TEXT BOOKS:

1. Ben Gold and Nelson Morgan ,"Speech and Audio signal processing- processing and perception of speech and music", John Wiley and sons 2006
2. Rabiner L.R and R. W. Schafer, "Introduction to Digital Signal Processing, Foundations and Trendsin Signal Processing", Vol. 1, Nos. 1–2 (2007)

REFERENCE BOOKS:

1. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.
2. Donglos O shanhnessy, "Speech Communication: Human and Machine", 2nd Ed. University press 2001.
3. Lawrence Rabiner, Biiing and– Hwang Juang and B.Yegnanarayana, "Fundamentals of Speech Recognition", Pearson Education, 2009.

191ECE805T WIRELESS NETWORKS

L	T	P	R	C
3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To understand the working of WI-fi, 3G systems such as UMTS, CDMA 2000
- To learn 4G networks
- To know about ad hoc and sensor network
- To learn about WLAN, WWAN, Wimax and LTE

UNIT I : WIRELESS LOCAL AREA NETWORKS 9

Introduction to wireless LANs - IEEE 802.11 WLANs - Physical Layer-

MAC sublayer- MAC Management Sublayer- Wireless ATM - HIPERLAN- HIPERLAN-2

UNIT II : 3G OVERVIEW & 2.5G EVOLUTION 9

Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture, CDMA2000 overview- Radio and Network components, Network structure, Radio network, TD-CDMA, TDSCDMA

UNIT III : ADHOC & SENSOR NETWORKS 9

Characteristics of MANETs, Table-driven and Source-initiated On Demand routing protocols, Hybrid protocols, Wireless Sensor networks- Classification, MAC and Routing protocols.

UNIT IV : INTERNETWORKING BETWEEN WLANS AND 3G WWANS 9

Internetworking objectives and requirements, Schemes to connect WLANs and 3G Networks, Session Mobility, Internetworking Architectures for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution system

UNIT V : 4G & BEYOND 9

4G features and challenges, Technology path, IMS Architecture, WiMAX, LTE, Convergent Devices, 4G technologies, Advanced Broadband Wireless Access and Services, Multimedia, MVNO.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
2. Analyze different routing techniques in ad hoc and sensor network
3. Demonstrate internetworking between different wireless networks
4. Describe 4G features and challenges

TEXT BOOKS:

1. Clint Smith. P.E., and Daniel Collins, “3G Wireless Networks”, 2nd Edition, Tata McGraw Hill, 2007.
2. Vijay. K. Garg, “Wireless Communication and Networking”, Morgan Kaufmann Publishers,2007

REFERENCE BOOKS:

1. Andrew Richardson, “WCDMA design Handbook” Cambridge University Press,2007
2. Dharma Prakash Agrawal & Qing-An Zeng, “Introduction to Wireless and Mobile Systems”,Thomson India Edition, 2nd Ed., 2007.
3. Gary. S. Rogers & John Edwards, “An Introduction to Wireless Technology”, Pearson
4. Education, 2007.
5. Jochen Schiller, " Mobile Communication", 2nd Edition, Pearson Education Limited 2003
6. William Stallings, "Wireless Communications and networks" Pearson / Prentice Hall of India,Ed., 2007

E-BOOKS / WEB REFERENCES:

1. http://books.elsevier.com/9780123735805: 2007

191ITE821T	MOBILE COMPUTING	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- Understand the basic concepts of mobile computing
- Understand Wireless LAN, Bluetooth and Wi-Fi Technologies
- Be familiar with the network protocol stack
- Learn the basics of mobile telecommunication system and satellite systems
- Be exposed to Ad-Hoc networks

UNIT I : INTRODUCTION **9**

Introduction to Mobile Computing – Applications of Mobile Computing- Multiplexing – MAC Protocols – SDMA- TDMA- FDMA- CDMA

UNIT II : MOBILE TELECOMMUNICATION SYSTEMS 9

GSM – System Architecture - Protocols – Connection Establishment – Localization and calling – Handover– Security –UMTS-4G Vision-Features and Challenges-Applications.

UNIT III : WIRELESS LAN 9

IEEE 802.11 Standard – System Architecture – Protocol Architecture - MAC management– HIPERLAN- Blue Tooth- Wi-Max.

UNIT IV : MOBILE NETWORK LAYER AND SATELLITE SYSTEMS 9

Mobile IP – DHCP – Mobile ad-hoc networks– Satellite systems-GEO-LEO-MEO-Routing.

UNIT V : MOBILE TRANSPORT AND APPLICATION LAYER 9

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WML – WML Script.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Explain the basics of mobile telecommunication system.
2. Illustrate the generations of telecommunication systems in wireless network.
3. Understand the architecture of Wireless LAN technologies.
4. Determine the functionality of network layer and Identify a routing protocol for a given Ad hoc networks.
5. Explain the functionality of Transport and Application layer.

TEXT BOOKS:

1. Jochen Schiller, “Mobile Communications”, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt.Ltd, New Delhi – 2012

REFERENCE BOOKS:

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005
2. Toh C.K, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.
3. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003
4. William.C.Y.Lee,"Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition, Tata Mc Graw Hill Edition ,2006.

191MBE821T TOTAL QUALITY MANAGEMENT

L	T	P	R	C
3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To facilitate the understanding of Quality Management principles and process.

UNIT I : INTRODUCTION **9**

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

UNIT II : TQM PRINCIPLES **9**

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

UNIT III : TQM TOOLS AND TECHNIQUES I **9**

The seven traditional tools of quality – New management tools – Six sigma: Concepts, Methodology, applications to manufacturing, service

sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV : TQM TOOLS AND TECHNIQUES II 9

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

UNIT V : QUALITY SYSTEMS 9

Need for ISO 9000 – ISO 9001-2008 Quality System – Elements, Documentation, Quality Auditing – QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – TQM Implementation in manufacturing and service sectors, NBA, CMM, BVQI.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. To apply quality philosophies and tools to facilitate continuous improvement and ensure customer delight.

TEXT BOOKS:

1. Dale H. Besterfiled, et al., “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint 2006.

REFERENCE BOOKS:

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006.

191ECE811T	MEMS AND NEMS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To introduce the concepts of micro and nano electromechanical devices
- 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

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 Nano electromechanical 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 : NANO DEVICES **9**

Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nanorods based NEMS device: Gas sensor.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Interpret the basics of micro/nano electromechanical systems including their applications and advantages
2. Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.
3. Analyze the key performance aspects of electromechanical transducers including sensors and actuators
4. Comprehend the theoretical foundations of quantum mechanics and Nano systems

TEXT BOOKS:

1. Chang Liu, “Foundations of MEMS”, Pearson education India limited, 2006.
2. Marc Madou, “Fundamentals of Microfabrication”, CRC press 1997.

REFERENCE BOOKS:

1. Sergey Edward Lyshevski, “MEMS and NEMS: Systems, Devices, and Structures” CRC Press, 2002
2. Stephen D. Senturia,” Micro system Design”, Kluwer Academic Publishers,2001
3. Tai Ran Hsu ,”MEMS and Microsystems Design and Manufacture” ,Tata Mcraw Hill, 2002.

191ECE812T	**INFORMATION THEORY AND CODING**	**L**	**T**	**P**	**R**	**C**
		3	**0**	**0**	**0**	**3**

PREREQUISITES: NIL

COURSE OBJECTIVES:

- Study the basic concepts information theory.
- Understand the concept of error control coding: block code, convolution codes.
- Learn various Image and Video Formats

UNIT I : INFORMATION THEORY 9

Information – Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Mutual information - Discrete memoryless channels – BSC, BEC – Channel capacity, Shannon limit.

UNIT II : ERROR CONTROL CODING: BLOCK CODES 9

Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder – CRC.

UNIT III : ERROR CONTROL CODING: BCH CODES 9

Binary primitive BCH codes, Decoding procedures, Implementation of Galois field Arithmetic, Implementation of Error correction. Non – binary BCH codes: q –ary Linear Block Codes, Primitive BCH codes over GF (q), Reed –Solomon Codes, Decoding of Non –Binary BCH and RS codes: The Berlekamp – Massey Algorithm.

UNIT IV : ERROR CONTROL CODING:CONVOLUTIONAL CODES 9

Encoding of Convolutional codes, Structural properties, Distance properties, Viterbi Decoding Algorithm for decoding, Soft –output Viterbi Algorithm, Stack and Fano sequential decoding Algorithms, Majority logic decoding.

UNIT V : ERROR CONTROL CODING: CONCATENATED CODES & TURBO CODES 9

Single level Concatenated codes, Multilevel Concatenated codes, Soft decision Multistage decoding, Concatenated coding schemes with Convolutional Inner codes, Introduction to Turbo coding and their distance properties, Design of Turbo codes.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Understand the concepts of information theory.
2. Identify the errors using error control coding: block code, convolution codes.
3. Knowledge on various Image and Video Formats.

TEXT BOOKS:

1. Bose R, “Information Theory, Coding and Cryptography”, TMH 2007. (For units-3,4&5)
2. Shu Lin & Daniel J. Costello, Jr, “Error Control Coding” Pearson / Prentice Hall, Second Edition, 2004. (For units-1&2)

REFERENCE BOOKS:

1. Amitabha Bhattacharya, “Digital Communication”, TMH 2006.
2. Gravano S, “Introduction to Error Control Codes”, Oxford University Press 2007.

191ECE813T	MULTIMEDIA COMPRESSION AND COMMUNICATION	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To understand the compression schemes for text, voice, image and video
- To understand the QoS issues in multimedia network
- To know the communication protocols for multimedia networking

UNIT I : AUDIO COMPRESSION **9**

Sampling and Quantization of Speech (PCM) - Adaptive differential PCM - Delta Modulation - Vector Quantization- Linear predictive coding (LPC) - Code excited Linear predictive Coding (CELP)

UNIT II : IMAGE AND VIDEO COMPRESSION **9**

Graphics Interchange format- Tagged image file format-Digitized documents- Digitized pictures JPEG-Video Encoding-Motion estimation –Overview of H.263 and MPEG-2

UNIT III : TEXT COMPRESSION 9

Static and Dynamic Huffman coding – Arithmetic coding –Lempel-Ziv coding – LZW coding

UNIT IV : GUARANTEED SERVICE MODEL 9

Best Effort service model – Scheduling and Dropping policies – Network Performance Parameters – Quality of Service and metrics – WFQ and its variants – Random Early Detection – QoS aware Routing – Admission Control – Resource Reservation – RSVP - Traffic Shaping Algorithms – Caching - Possible Architectures – An Overview of QoS Architectures

UNIT V : MULTIMEDIA COMMUNICATION 9

Stream characteristics for Continuous media – Temporal Relationship – Object Stream Interactions, Media Levity, Media Synchronization – Models for Temporal Specifications – Streaming of Audio and Video – Jitter – Fixed playout and Adaptive playout – Recovering from packet loss – RTSP –– Multimedia Communication Standards – RTP/RTCP – SIP and H.263

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

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

1. Design audio compression techniques
2. Configure Text, image and video compression techniques
3. Select suitable service model for specific application and configure multimedia communication network

TEXT BOOKS:

1. Fred Halsall, “Multimedia communication- Applications, Networks, Protocols and Standards”, Pearson education, 2007.

REFERENCE BOOKS:

1. Ellen Kayata Wesel, “Wireless Multimedia Communications: Networking Video, Voice and Data”, Addision Wesley, 1998
2. Kurose and W. Ross, “Computer Networking —A Top Down Approach”, Pearson education, 3rd ed, 2005
3. Nalin K Sharda, “Multimedia Information Networking”, Prentice Hall of India, 1999
4. Tay Vaughan, “Multimedia Making it work”, McGraw-Hill Osborne Media, 2006.

List of Open Elective Courses **(3 0 0 0 3)**

Open Elective I

Sl. No.	**Course Code**	**Course Title**
1.	191ECO501T	Embedded Systems
2.	191ECO502T	Consumer Electronics

Open Elective II

Sl. No.	**Course Code**	**Course Title**
1.	191ECO601T	Principles of Modern Communication Systems
2.	191ECO602T	Internet of Things Sensing and Actuator Devices

Open Elective III

Sl. No.	**Course Code**	**Course Title**
1.	191ECO701T	Electronics Packing & Testing
2.	191ECO702T	Cryptography and Network Security
3.	191ECO703T	Soft Computing

191ECO501T	EMBEDDED SYSTEMS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. To introduce the Building Blocks of Embedded System
2. To Educate in Bus Architecture and Networks
3. To impart knowledge in various scheduling algorithms
4. To introduce Real time operating systems
5. To inculcate knowledge to design an application system

UNIT 1 INTRODUCTION TO EMBEDDED SYSTEMS **9**

Introduction to Embedded Systems – Structural units in a processor, selection of processor, memory devices and peripherals- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, sensors, Actuators, In circuit emulator

UNIT 2 EMBEDDED NETWORKING **9**

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols - RS232 standard – RS422 – RS485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers

UNIT 3 REAL TIME OPERATING SYSTEM CONCEPTS **9**

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, Mutex, priority inversion, priority inheritance, priority ceiling

UNIT 4 RTOS PROGRAMMING TOOLS **9**

Need for a well-tested and debugged Real Time Operating system, Architecture and comparison of Real time Operating systems: Vx Works, чC/OS-II, POSIX, RT Linux

UNIT 5 EMBEDDED SYSTEM APPLICATION DEVELOPMENT **9**

Embedded Product Development Life Cycle- Case Study of Washing Machine- Adaptive Cruise control system in a Car- Smart card System Application, Audio player, Software modem

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

CO1: to understand and analyze Embedded systems

CO2: to study about the bus Communication in processors

CO3: to acquire knowledge on various processor scheduling algorithms

CO4: to understand basics of Real time operating system

CO5: to suggest an embedded system for a given application

CO6: to operate various Embedded Development Strategies

TEXT BOOKS:

1. Raj Kamal,"Embedded System-Architecture, Programming, Design", Mc Graw Hill, 2013.

REFERENCE BOOKS:

1. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013.
2. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", Third Edition"Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
3. Peckol, "Embedded system Design", John Wiley & Sons,2010
4. Sarma C.R., "Embedded Systems Engineering", University Press (India) Pvt. Ltd, 2013.
5. Shibu. K.V, "Introduction to Embedded Systems", TMGH 2009.
6. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.

191ECO502T	CONSUMER ELECTRONICS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. Understand the basic electronic components
2. Familiarize the electronic components to be used for appliances
3. Apply the knowledge of electronics on smart-home systems

UNIT 1 CONSUMER ELECTRONICS FUNDAMENTALS 9

History of Electronic Devices- Vacuum Tubes, Transistors, Integrated Circuits- Moore's Law, Semiconductor Devices, Diodes, Rectifiers, Transistors, Logic Gates, Combinational Circuits, ADC, DAC and Microprocessors, Microprocessor Vs Microcontrollers, Microcontrollers in consumer electronics, Energy management, Intelligent Building Perspective.

UNIT 2 ENTERTAINMENT ELECTRONICS 9

Audio systems: Construction and working principle of: Microphone, Loud speaker, AM and FM receiver, stereo, 2.1 home theatre, 5.1 home theatre, Display systems: CRT, LCD, LED and Graphics displays Video Players: DVD and Blue RAY. Recording Systems: Digital Cameras and Camcorders.

UNIT 3 SMART HOME 9

Technology involved in Smart home, Home Virtual Assistants- Alexa and Google Home. Home Security Systems - Intruder Detection, Automated blinds, Motion Sensors, Thermal Sensors and Image Sensors, PIR, IR and Water Level Sensors.

UNIT 4 HOME APPLIANCES 9

Home Enablement Systems: RFID Home, Lighting control, Automatic Cleaning Robots, Washing Machines, Kitchen Electronics- Microwave, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart toilet, Smart floor, Smart locks.

UNIT 5 COMMUNICATION SYSTEMS 9

Cordless Telephones, Fax Machines, PDAs - Tablets, Smart Phones and Smart Watches, Introduction to Smart OS - Android and iOS. Video Conferencing Systems - Web/IP Camera, Video security, Internet Enabled Systems, Wi-Fi, IoT, Li-Fi, GPS and Tracking Systems.

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

CO1: To design basic circuits for home based applications

CO2: To understand the working of home appliances

CO3: To design communication systems for tracking and conferencing

TEXT BOOKS:

1. Dennis C Brewer, "Home Automation", Que Publishing 2013.
2. Jordan Frith, "Smartphones as Locative Media ", Wiley. 2014.
3. Thomas L Floyd "Electronic Devices" 10th Edition Pearson Education Asia 2018.
4. Thomas M. Coughlin, "Digital Storage in Consumer Electronics", Elsevier and Newness 2012.
5. Philip Hoff "Consumer Electronics for Engineers" - Cambridge University Press. 1998.

REFERENCE BOOKS:

1. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013.
2. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", Third Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
3. Peckol, "Embedded system Design", John Wiley & Sons,2010
4. Sarma C.R., "Embedded Systems Engineering", University Press (India) Pvt. Ltd, 2013.
5. Shibu. K.V, "Introduction to Embedded Systems", TMGH 2009.
6. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.

191ECO601T	PRINCIPLES OF MODERN COMMUNICATION SYSTEMS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. To learn about the basic principles of analog and digital communication.
2. To study about the concept of mobile communication
3. To get idea about the applications of wireless networks
4. To learn about the principles of satellite, radar and navigation system

UNIT 1 ANALOG AND DIGITAL COMMUNICATION **9**

History of communication – Primary communication resources – Basic elements of communication systems – Block diagram of analog and digital communication – Electromagnetic spectrum with applications – Outline of analog communication – AM, FM, PM – Mathematical and waveform representation – Outline of digital communication - ASK, FSK, PSK – Sampling theorem - Nyquist rate – ISI- Basics of pulse code modulation

UNIT 2 MOBILE COMMUNICATION **9**

Evolution of mobile radio communication, Mobile radio systems - paging, cordless, cellular, GSM – GSM services and features – GSM architecture – Cellular technology – frequency reuse, channel assignment, Handoff strategies, Interference and system capacity, Improving coverage in cellular system – Cell splitting, Sectoring, Repeaters and Microcell

UNIT 3 WIRELESS NETWORKS **9**

Introduction – Multiple access technique – FDMA, TDMA,CDMA, Second generation wireless network, Third generation wireless network- Wireless local area networks- IEEE 802.11 architecture, Bluetooth - IEEE 802.15 architecture, IEEE 802.16 (Wi -MaX) - Introduction to 5G – Internet of Things- Architecture of future networks

UNIT 4 SATELLITE COMMUNICATION **9**

History of Satellites, Fundamentals of satellite - Kepler's laws, orbits, Antenna look angle, Communication satellite- classification, frequency allocation, antenna radiation pattern, Satellite system link model- uplink, downlink, transponder, satellite system parameters- Link equation- Satellite radio navigation- Navstar GPS- Satellite ranging

UNIT 5 RADAR & NAVIGATION SYSTEM **9**

Introduction to Radar - Block diagram and Operation of radar - Radar Frequencies - Applications of Radar - Doppler effect- Introduction to navigation- categories of navigation - Basic Instruments- gyroscope, gravity sensor – Landing systems - Instrument Landing System, Microwave landing system, satellite landing system

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

CO1: Outline the types of analog, digital communication systems

CO2: Explain the technologies used in cellular communication

CO3: Brief out the recent technologies implemented with wireless networks

CO4: Enumerate the points on fundamentals of satellite communication system

CO5: Outline the principles of radar and navigation system

TEXT BOOKS:

1. Haykin S., "Communication Systems", 4/e, John Wiley 2007.
2. JochenH.Schiller, "Mobile communications", 2nd edition, Pearson education,2013.
3. Lathi B.P., "Modern Digital and Analog Communication Systems", 3/e, Oxford University Press,2007.

REFERENCE BOOKS:

1. Rappaport Theodore S, "Wireless Communications: Principles and Practice", 2/E, Pearson EducationIndia, 2010
2. Skolnik M. I, "Introduction to Radar Systems" Tata McGraw Hill 2006.
3. Myron Kyton and W.R.Fried , "Avionics Navigation Systems", John Wiley & Sons 1997.
4. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, 2007.
5. Wayne Tomasi, "Advanced Electronic communication systems", 6th edition, Pearson Education, 2011.

191ECO602T	INTERNET OF THINGS SENSING AND ACTUATOR DEVICES	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. To understand the basics of Internet of Things
2. To get an idea of some of the application areas where Internet of Things can be applied
3. To understand the middleware for Internet of Things
4. To Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules

UNIT 1 INTRODUCTION **9**

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security

UNIT 2 IOT PROTOCOLS **9**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security

UNIT 3 IOT SENSORS **9**

Industrial sensors – Description & Characteristics–First Generation – Description &Characteristics–Advanced Generation – Description & Characteristics–Integrated IoTSensors – Description & Characteristics–Polytronics Systems – Description &Characteristics–Sensors' Swarm – Description & Characteristics–Printed Electronics –Description & Characteristics–IoT Generation Roadmap

UNIT 4 TECHNOLOGICAL ANALYSIS **9**

Wireless Sensor Structure–Energy Storage Module–Power Management Module – RF Module–Sensing Module

UNIT 5 APPLICATIONS **9**

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

CO1: Identify and design the new models for market strategic interaction

CO2: Design business intelligence and information security for WoB

CO3: Analyze various protocols for IoT Design a middleware for IoT

CO4: Analyze and design different models for network dynamics

TEXT BOOKS:

1. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press - 2010
2. Guillaume Girardin, Antoine Bonnabel, Dr. Eric Mounier, "Technologies & Sensors for the Internet of Things Businesses & Market Trends" 2014 – 2024.
3. Honbo Zhou, Dieter Uckelmann; Mark Harrison, "The Internet of Things in the Cloud: A Middleware Perspective" - CRC Press ,2012
4. Architecting the Internet of Things - Florian Michahelles- (Eds.) – Springer – 2011

REFERENCE BOOKS:

1. Ida N, Sensors," Actuators and Their Interfaces", Scitech Publishers, 2014.
2. Olivier Hersent, Omar Elloumi and David Boswarthick, "The Internet of Things: Applications to the Smart Grid and Building Automation" Wiley -2012
3. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012

191ECO701T	ELECTRONIC PACKAGING AND TESTING	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. To introduce and discuss various issues related to the system packaging
2. To understand the concepts of Testing and testing methods
3. To learn the design of packages which can withstand higher temperature, vibrations and shock

UNIT 1 OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING 9

Functions of an Electronic Package, Packaging Hierarchy, IC packaging: MEMS packaging, consumer electronics packaging, medical electronics packaging, Trends. Materials for Microsystems packaging, Packaging Materials and Properties, Materials Processes, Trends

UNIT 2 ELECTRICAL PACKAGE DESIGN AND RF PACKAGING 9

Fundamentals of Electrical Package Design, Electrical Anatomy of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Design Process. Anatomy of RF Systems, Fundamentals of RF, RF Packaging, RF Measurement Techniques, Trends

UNIT 3 CHIP PACKAGES 9

IC Assembly - Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging, reliability, wafer level burn – in and test. Single chip packaging: functions, types, materials processes, properties, characteristics, trends. Multi chip packaging: types, design, comparison, trends. System – in - package (SIP); Fundamentals of Passives: discrete, integrated and embedded

UNIT 4 PWB, SURFACE MOUNT TECHNOLOGY AND THERMAL CONSIDERATIONS 9

Printed Wiring Board: Anatomy, CAD tools for PWB design, Standard fabrication, Micro via Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges. Thermal Management, Cooling requirements for Microsystems, Thermal Management Fundamentals, Thermal Management of IC and PWB Packages, Electronic Cooling Methods

UNIT 5 TESTING 9

Reliability: Design for reliability, Microsystems failures and failure mechanisms, Failures – thermo mechanically induced failures –electrically induced failures – chemically induced failures. Fundamentals of Electrical Testing: Anatomy of system level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

CO1: Give a comprehensive introduction to the various packaging types used along with the associated thermal, speed, signal and integrity power issues

CO2: Enable design of packages which can withstand higher temperature, vibrations and shock

CO3: Design of PWBs which minimize the EMI and operate at higher frequency

CO4: Analyze the concepts of Testing and testing methods

TEXT BOOKS:

1. Tummala, Rao R., “Fundamentals of Microsystems Packaging”, McGraw Hill, 2001

REFERENCE BOOKS:

1. Abramovici M., Breuer M. A., and Friedman A.D., “Digital System Testing and Testable Design”, Computer Science Press,1990
2. Blackwell (Ed), “The electronic packaging handbook”, CRC Press, 2000.
3. Bosshart, “Printed Circuit Boards Design and Technology”, TataMcGraw Hill, 1988.
4. Kaduskar R.G. and Baru V.B., “Electronic Product design”, Wiley India, 2011
5. Khandpur R.S., “Printed Circuit Board”, Tata McGraw Hill, 2005
6. Michael L. Bushnell & Vishwani D. Agrawal, “Essentials of Electronic Testing for Digital, memory & Mixed signal VLSI Circuits”, Kluwer Academic Publishers.2000.
7. Tummala, Rao R, “Microelectronics packaging handbook”, McGraw Hill, 2008.

E-BOOKS / WEB REFERENCES:

1. Recent literature in Electronic Packaging

191ECO702T **CRYPTOGRAPHY AND NETWORK SECURITY**

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

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. To understand Cryptography Theories, Algorithms and Systems
2. To understand necessary Approaches and Techniques
3. To build protection mechanisms in order to secure computer networks

UNIT 1 INTRODUCTION **9**

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography) - Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis

UNIT 2 SYMMETRIC 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: SDES – Block cipher 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 - RC4 – Key distribution

UNIT 3 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 - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography

UNIT 4 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 5 SECURITY PRACTICE AND SYSTEM SECURITY **9**

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of networks security, security architecture, threats and vulnerabilities

CO2: Apply the different cryptographic operations of symmetric cryptographic algorithms

CO3: Apply the different cryptographic operations of public key cryptography

CO4: Apply the various Authentication schemes to simulate different applications

CO5: Understand various Security practices and System security standards

TEXT BOOKS:

1. William Stallings, “Cryptography and Network Security: Principles and Practice”, PHI 3rd Edition, 2006.

REFERENCE BOOKS:

1. Behrouz A.Foruzan, “Cryptography and Network Security”, Tata McGraw Hill 2007.
2. Charlie Kaufman, Radia Perlman, and Mike Speciner, “Network Security: PRIVATE Communication in a PUBLIC World”, Prentice Hall, ISBN 0-13-046019-2.
3. Shyamala C K, Harini N and Padmanabhan T R: “Cryptography and Network Security”, Wiley India Pvt.Ltd

191ECO703T **SOFT COMPUTING**

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

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. Classify the various soft computing frame works
2. Be familiar with the design of neural networks, fuzzy logic and fuzzy systems
3. Learn mathematical background for optimized genetic programming
4. Be exposed to neuro-fuzzy hybrid systems and its applications

UNIT 1 INTRODUCTION TO SOFT COMPUTING **9**

Soft Computing Constituents-From Conventional AI to Computational Intelligence- Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks.basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm-Introduction - biological background - traditional optimization and search techniques

UNIT 2 NEURAL NETWORKS **9**

McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN-associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self-organizing feature maps, LVQ – CP networks, ART network

UNIT 3 FUZZY LOGIC **9**

Membership functions: features, fuzzification, methods of membership value assignments-Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making, fuzzy logic control systems

UNIT 4 GENETIC ALGORITHM **9**

Genetic Algorithm and search space, Genetic Algorithm vs. Traditional Algorithm, basic terminologies of GA, Simple GA - flow chart - operators – Encoding scheme – Fitness evaluation – crossover - mutation - genetic programming – multilevel optimization – real life problem- advances in GA

UNIT 5 HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS **9**

Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers, Introduction -soft computing tools

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

CO1: Apply various soft computing concepts and tools for practical applications

CO2: Choose and design suitable neural network for real time problems

CO3: Use fuzzy rules and reasoning to develop decision making and expert system

CO4: Explain the importance of optimization techniques and genetic programming

CO5: Review the various hybrid soft computing techniques and apply in real time problems

TEXT BOOKS:

1. Jang J.S.R., Sun C.T. and Mizutani E., “Neuro-Fuzzy and Soft Computing”, PHI / Pearson Education 2004.
2. Sivanandam S.N. and Deepa S.N., "Principles of Soft Computing", Wiley India Pvt Ltd, 2nd edition, 2011.

REFERENCE BOOKS:

1. David E. Goldberg, “Genetic Algorithm in Search Optimization and Machine Learning” Pearson Education India, 2013.
2. George J. Klir, Ute St. Clair, Bo Yuan, “Fuzzy Set Theory: Foundations and Applications” Prentice Hall, 1997.
3. James A. Freeman, David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India, 1991.
4. Rajasekaran S. and Vijayalakshmi Pai G.A., "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.
5. Simon Haykin, “Neural Networks Comprehensive Foundation” Second Edition, Pearson Education, 2005