NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamilnadu, India, Phone: 04294 – 225585

Curriculum and Syllabi
for
B.E – Electronics and Communication Engineering [R17]
[CHOICE BASED CREDIT SYSTEM]

(This Curriculum and Syllabi are applicable to Students admitted from the academic year 2017-2018 onwards)

APRIL 2023

ECE Department PEO'S and PO'S

PROGRAMME EDUCATIONAL OBJECTIVES:

PEO1: To inculcate the ethical values for professional development of the students to solve complex problems and attain solutions leading to societal benefits.

PEO2: To empower the technical ability and contemporary knowledge of the students to achieve professional skills and ensure the leadership qualities through soft skill training.

PEO3: To enable the students to adapt to emerging technologies through self learning and analysis in the area of Electronics and Communication.

PEO4: To continue their education in leading graduate programs in engineering and interdisciplinary areas to emerge as researchers, experts and educators.

PEO5: To excel their careers by being a part of success and growth of an organization with which they are associated.

PROGRAM OUTCOMES:

At the end of a programme a students will be able to demonstrate ability to

a-l	GRADUATE ATTRIBUTES	PO No.	PROGRAMME OUTCOMES
a	Engineering Knowledge	PO1	An ability to apply knowledge of mathematics, sciences, semiconductor theory to solve problems in the area of Signal processing, Embedded systems, VLSI & Communication systems
b	Problem Analysis	PO2	An ability to identify, formulate and analyze complex Electronics & Communication problems in the real world.
c	Design and Development of Solutions	PO3	An ability to design system components or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical and sustainability.
d	Investigation of Complex Problems	PO4	An ability to conduct experiments, analyze and interpret experimental results to provide valid conclusion.
e	Modern Tool Usage	PO5	An ability to apply techniques, skills and modern engineering tools required for ECE applications.
f	The Engineer and Society	PO6	An ability to perform in multidisciplinary areas.
g	Environment and Sustainability	PO7	An ability to understand the impact of ECE solutions in a global, economic, environmental and societal context.
h	Ethics	PO8	An ability to apply professional and ethical principles with responsibility.
i	Individual and Team Work.	PO9	An ability to function in multidisciplinary teams exhibiting innate abilities towards team building.
j	Communication	PO10	An ability to communicate effectively.
k	Project Management and Finance	PO11	An ability to apply, design and implement application oriented projects.
l	Lifelong Learning	PO12	An ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES:

PSO1: Apply a systematic approach to the solution of problems in the field of Electronics and Communication Engineering.

PSO2: Engage in lifelong learning, commitment to quality and continuous improvement.

PSO3: Ability to work in multidisciplinary groups.

PSO4: Design applications related to Signal Processing, Computer Networks and Communication.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

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

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	A	B	C	D	E	F	G	H	I	J	K	L
1	3	3	2	3	2	1	1	2	1	1	3	1
2	3	3	3	3	3	1	1	1	1	1	1	2
3	3	3	3	3	3	2	2	3	1	2	2	2
4	3	3	3	2	3	2	1	2	1	1	1	2
5	3	3	2	3	2	1	1	3	1	1	2	1

MAPPING OF PROGRAM SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

PROGRAM SPECIFIC OUTCOMES	PROGRAMME OUTCOMES											
	A	B	C	D	E	F	G	H	I	J	K	L
1	3	3	2	3	2	1	1	1	1	1	1	2
2	3	3	3	3	3	2	2	3	1	3	3	3
3	3	3	3	3	3	3	3	2	1	1	1	3
4	3	3	2	3	3	2	2	3	1	2	2	2

Contribution **1: Reasonable** **2: Significant** **3: Strong**

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 052

REGULATIONS – 2017 **CHOICE BASED CREDIT SYSTEM**

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULAM: I – VIII SEMESTERS **SYLLABUS: 1 to 8 SEMESTERS**

SEMESTER: I									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17EYA01	Professional English- I	HS	-	4	2	0	2	3
2.	17MYB01	Calculus and Solid Geometry	BS	-	5	3	2	0	4
3.	17PYB01	Physics for Engineers	BS	-	3	3	0	0	3
4.	17CYB02	Applied Electrochemistry	BS	-	3	3	0	0	3
5.	17CSC02	Python Programming	ES	-	3	3	0	0	3
6.	17ECC01	Electronic Devices	ES	-	3	3	0	0	3
PRACTICAL									
7.	17CSP02	Python Programming Laboratory	ES	-	4	0	0	4	2
8.	17GYP02	Engineering Practices Laboratory	ES	-	4	0	0	4	2
9.	17GEP01	Personal Values	HS	-	2	0	0	2	0
				TOTAL	**31**	**17**	**2**	**12**	**23**

SEMESTER: II									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17EYA02	Professional English – II	HS	17EYA01	4	2	0	2	3
2.	17MYB02	Complex Analysis and Laplace Transforms	BS	17MYB01	5	3	2	0	4
3.	17PYB05	Physics of Solids	BS	17PYB01	3	3	0	0	3
4.	17CYB03	Environmental Science	BS	-	3	3	0	0	3
5.	17MEC01	Engineering Graphics	ES	-	4	2	2	0	3
6.	17ECC03	Circuit Theory	ES	-	3	3	0	0	3
PRACTICAL									
7.	17GYP01	Physics and Chemistry Laboratory	BS	-	4	0	0	4	2
8.	17ECP01	Circuits and Devices Laboratory	ES	17ECC01	4	0	0	4	2
9.	17GEP02	Inter Personal Values	HS	17GEP01	2	0	0	2	0
				TOTAL	**32**	**16**	**4**	**12**	**23**

SEMESTER: III									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17MYB05	Transforms and Partial Differential Equations	BS	17MYB02	4	2	2	0	3
2.	17ITC03	Data Structures and Algorithms	ES	-	4	2	0	2	3
3.	17ECC05	Electrical Machines and instruments	ES	-	3	3	0	0	3
4.	17ECC06	Digital Logic Design	PC	17ECC01	3	3	0	0	3
5.	17ECC07	Signals and Systems	PC	17MYB02	4	2	2	0	3
6.	17ECC08	Analog Electronics	PC	17ECC01	3	3	0	0	3
PRACTICAL									
7.	17ECP03	Digital Logic Design Laboratory	PC	17ECP01	4	0	0	4	2
8.	17ECP04	Analog Electronics Laboratory	PC	17ECP01	4	0	0	4	2
9.	17GED02	Soft Skills-Reading and Writing	EEC	-	2	0	0	2	0
				TOTAL	**31**	**15**	**4**	**12**	**22**

SEMESTER: IV									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17MYB09	Probability and Random Processes	BS	17MYB02	4	2	2	0	3
2.	17ITC08	Fundamentals of Java Programming	ES	-	4	2	0	2	3
3.	17ECC10	Electromagnetic Fields	ES	17PYB01	4	2	2	0	3
4.	17ECC11	Analog Circuit Design	PC	17ECC01	3	3	0	0	3
5.	17ECC12	Digital Signal Processing	PC	-	4	2	2	0	3
6.	E1	Elective I (PSE)	PSE	-	3	3	0	0	3
PRACTICAL									
7.	17ECP06	Analog Circuit Design Laboratory	PC	17ECP01	4	0	0	4	2
8.	17ECP07	Digital Signal Processing Laboratory	PC	17ECC07	4	0	0	4	2
9.	17GED01	Soft Skills-Listening and Speaking	EEC	-	2	0	0	2	0
10.	17GED03	Personality and Character Development	EEC	-	1	0	0	1	0
				TOTAL	**33**	**14**	**6**	**13**	**22**

SEMESTER: V									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17GEA02	Principles of Management	HS	-	3	3	0	0	3
2.	17ECC13	Microprocessors and Microcontrollers Interfacing	PC	17ECC06	3	3	0	0	3
3.	17ECC14	Data Communication and Networks	PC	17ECC06	3	3	0	0	3
4.	17ECC15	Transmission Lines and Waveguides	PC	17ECC10	4	2	2	0	3
5.	E2	Elective II (PSE)	PSE	-	3	3	0	0	3
6.	E3	Elective III (PSE)	PSE	-	3	3	0	0	3
PRACTICAL									
7.	17ECP08	Microprocessors and Microcontrollers Interfacing Laboratory	PC	17ECP03	4	0	0	4	2
8.	17ECP09	Data Communication and Networks Laboratory	PC	17ECP03	4	0	0	4	2
9.	17GED08	Essence of Indian Traditional Knowledge	EEC	-	2	0	0	2	0
				TOTAL	**29**	**17**	**2**	**10**	**22**

SEMESTER: VI									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17ECC16	Analog and Digital Communication	PC	17ECC06	3	3	0	0	3
2.	17ECC17	VLSI Design	PC	17ECC13	3	3	0	0	3
3.	E4	Elective IV (PSE)	PSE	-	3	3	0	0	3
4.	E5	Elective V (PSE)	PSE	-	3	3	0	0	3
5.	E6	Elective VI (PSE)	PSE	-	3	3	0	0	3
6.	E 7	Elective VII	PSE/OE	-	3	3	0	0	3
PRACTICAL									
7.	17ECP10	Analog and Digital Communication Laboratory	PC	17ECP03	4	0	0	4	2
8.	17ECP11	VLSI Design Laboratory	PC	17ECP08	4	0	0	4	2
9.	17GED06	Comprehension	EEC	ALL CORE SUBJECT	2	0	0	2	0
10.	17GED07	Constitution of India	EEC	-	2	0	0	2	0
				TOTAL	**31**	**17**	**0**	**14**	**22**

SEMESTER: VII									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17ECC19	Microwave Engineering	PC	17ECC18	3	3	0	0	3
2.	17ECC20	Optical Communication	PC	17ECC16	3	3	0	0	3
3.	17ECC21	Embedded and Real Time Systems	PC	17ECC13	3	3	0	0	3
4.	17ECC18	Antenna and Wave Propagation	PC	17ECC15	4	2	0	2	3
5.	E 8	Elective VIII	PSE/OE	-	3	3	0	0	3
PRACTICAL									
6.	17ECP12	Microwave and Optical Laboratory	PC	17ECP10	4	0	0	4	2
7.	17ECP13	Embedded Systems Laboratory	PC	17ECP08	4	0	0	4	2
8.	17ECD01	Project work-I	EEC	-	8	0	0	8	4
				TOTAL	**31**	**15**	**0**	**16**	**23**

SEMESTER: VIII									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	E 9	Elective IX (OE)	OE	-	3	3	0	0	3
PRACTICAL									
2.	17ECD02	Project work-II	EEC	17ECD01	16	0	0	16	8
				TOTAL	**19**	**3**	**0**	**16**	**11**

TOTAL NO. OF CREDITS: 168

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

REGULATIONS – 2017 **CHOICE BASED CREDIT SYSTEM**

(A) HS,BS, and ES Courses

(a) Humanities and Social Sciences (HS)			AICTE Credit Distribution Norm:12							
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17EYA01	Professional English-I	HS	-	4	2	0	2	3	I
2.	17GEP01	Personal Values	HS	-	2	0	0	2	0	I
3.	17EYA02	Professional English-II	HS	17EYA01	4	2	0	2	3	II
4.	17GEP02	Inter Personal Values	HS	17GEP01	2	0	0	2	0	II
5.	17GEA02	Principles of Management	HS		3	3	0	0	3	V

(b) Basic Sciences (BS)			AICTE Credit Distribution Norm:25							
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17MYB01	Calculus and Solid Geometry	BS	-	5	3	2	0	4	I
2.	17PYB01	Physics for Engineers	BS	-	3	3	0	0	3	I
3.	17CYB02	Applied Electrochemistry	BS	-	3	3	0	0	3	I
4.	17MYB02	Complex Analysis and Laplace Transforms	BS	17MYB01	5	3	2	0	4	II
5.	17PYB05	Physics of Solids	BS	17PYB01	3	3	0	0	3	II
6.	17CYB03	Environmental Science	BS	-	3	3	0	0	3	II
7.	17GYP01	Physics and Chemistry Laboratory	BS	-	4	0	0	4	2	II
8.	17MYB05	Transforms and Partial Differential Equations	BS	17MYB02	4	2	2	0	3	III
9.	17MYB09	Probability and Random Processes	BS	17MYB02	4	2	2	0	3	IV

(c) Engineering Sciences (ES)			AICTE Credit Distribution Norm:24							
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17CSC02	Python Programming	ES	-	3	3	0	0	3	I
2.	17ECC01	Electronic Devices	ES	-	3	3	0	0	3	I
3.	17CSP02	Python Programming Laboratory	ES	-	4	0	0	4	2	I
4.	17GYP02	Engineering Practices Laboratory	ES	-	4	0	0	4	2	I
5.	17MEC01	Engineering Graphics	ES	-	4	2	2	0	3	II
6.	17ECC03	Circuit Theory	ES	-	3	3	0	0	3	II
7.	17ECP01	Circuits and Devices Laboratory	ES	17ECC01	4	0	0	4	2	II
8.	17ECC05	Electrical Machines and instruments	ES	-	3	3	0	0	3	III

9.	17ITC03	Data Structures and Algorithms	ES	-	3	3	0	0	3	III
10.	17ECC10	Electromagnetic Fields	ES	17PYB01	3	3	0	0	3	IV
11.	17ITC08	Fundamentals of Java Programming	ES	-	3	2	0	2	3	IV

(B) Programme Core Courses (PC)			AICTE Credit Distribution Norm:48							
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17ECC06	Digital Logic Design	PC	17ECC01	3	3	0	0	3	III
2.	17ECP03	Digital Logic Design Laboratory	PC	17ECP01	4	0	0	4	2	III
3.	17ECC07	Signals and Systems	PC	17MYB02	3	3	0	0	3	III
4.	17ECC08	Analog Electronics	PC	17ECC01	3	3	0	0	3	III
5.	17ECP04	Analog Electronics Laboratory	PC	17ECP01	4	0	0	4	2	III
6.	17ECC11	Analog Circuit Design	PC	17ECC01	3	3	0	0	3	IV
7.	17ECP06	Analog Circuit Design Laboratory	PC	17ECP01	4	0	0	4	2	IV
8.	17ECC12	Digital Signal Processing	PC	-	3	3	0	0	3	IV
9.	17ECP07	Digital Signal Processing Laboratory	PC	17ECC07	4	0	0	4	2	IV
10.	17ECC13	Microprocessor and Microcontroller Interfacing	PC	17ECC06	3	3	0	0	3	V
11.	17ECP08	Microprocessors and Microcontrollers Interfacing Laboratory	PC	17ECP03	4	0	0	4	2	V
12.	17ECC14	Data Communication and Networks	PC	17ECC06	3	3	0	0	3	V
13.	17ECP09	Data Communication and Networks Laboratory	PC	17ECP03	3	3	0	0	3	V
14.	17ECC14	Transmission Lines and Waveguides	PC	17ECC10	3	3	0	0	3	V
15.	17ECC16	Analog and Digital Communication	PC	17ECC06	3	3	0	0	3	VI
16.	17ECP10	Analog and Digital Communication Laboratory	PC	17ECC06	3	3	0	0	3	VI
17.	17ECC17	VLSI Design	PC	17ECC13	3	3	0	0	3	VI
18.	17ECP11	VLSI Design Laboratory	PC	17ECP08	4	0	0	4	2	VI
19.	17ECC18	Antenna and Wave Propagation	PC	17ECC15	3	3	0	0	3	VI
20.	17ECC19	Microwave Engineering	PC	17ECC18	3	3	0	0	3	VII
21.	17ECC20	Optical Communication	PC	17ECC16	3	3	0	0	3	VII
22.	17ECC21	Embedded and Real Time Systems	PC	17ECC13	3	3	0	0	3	VII
23.	17ECP12	Microwave and Optical Laboratory	PC	17ECP10, 17ECC18	4	0	0	4	2	VII
24.	17ECP13	Embedded Systems Laboratory	PC	17ECP13	4	3	0	4	2	VII

(C) Elective Courses										
(a)Program Specific Electives(PSE)			**AICTE Credit Distribution Norm:18**							
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17ECX01	Medical Electronics	PSE	-	3	3	0	0	3	IV
2.	17ECX02	Nano Electronics	PSE	-	3	3	0	0	3	IV
3.	17ECX03	Radar and Navigational Aids	PSE	-	3	3	0	0	3	V
4.	17ECX04	Sensor and its Applications	PSE	-	3	3	0	0	3	V
5.	17ECX05	MEMS and its Application	PSE	-	3	3	0	0	3	VI
6.	17ECX06	Computer Hardware Interfacing	PSE	-	3	3	0	0	3	VI
7.	17ECX07	Control Systems Engineering	PSE	-	3	3	0	0	3	VI
8.	17ECX08	Digital Image Processing	PSE	-	3	3	0	0	3	VI
9.	17ECX09	Wireless Communication	PSE	-	3	3	0	0	3	VII
10.	17ECX10	High Speed Networks	PSE	-	3	3	0	0	3	VII
11.	17ECX11	Modern Microprocessors and Microcontrollers	PSE	-	3	3	0	0	3	VII
12.	17ECX12	Protocols and Architectures for Wireless Sensor Networks	PSE	-	3	3	0	0	3	VII
13.	17ECX13	Telecommunication Switching and Networks	PSE	-	3	3	0	0	3	VII
14.	17ECX14	Multimedia Compression Techniques	PSE	-	3	3	0	0	3	VIII
15.	17ECX15	Satellite Communication	PSE	-	3	3	0	0	3	VIII
16.	17ECX16	Internet of Things and its applications	PSE	-	3	3	0	0	3	VII
17.	17ECX17	Speech Processing	PSE	-	3	3	0	0	3	VII
18.	17ECX18	Opto Electronic Devices	PSE	-	3	3	0	0	3	VII
19.	17ECX19	Cryptography and Network Security	PSE	-	3	3	0	0	3	VI
20.	17ECX20	Statistical Theory of Communication	PSE	-	3	3	0	0	3	VII
21.	17ECX21	Cognitive Radio	PSE	-	3	3	0	0	3	VI
22.	17CSX01	Data Science	PSE	-	3	3	0	0	3	VIII
23.	17CSX26	HADOOP Distributed Environment	PSE	-	3	3	0	0	3	VIII
24.	17CSX31	Problem Solving And Programming	PSE	-	3	3	0	0	3	III
25.	17ITC12	Database Systems Concepts	PSE	-	3	3	0	0	3	VIII
26.	17ITX26	Problem Solving And Algorithmic Skills	PSE	-	3	3	0	0	3	VI
27.	17GEA03	Total Quality Management	PSE	-	3	3	0	0	3	VIII
28.	17GEA04	Professional Ethics and Human Values	PSE	-	3	3	0	0	3	VI
29.	17MYB12	Basic Statistics and Numerical Analysis	PSE	-	3	3	0	0	3	VI
30.	17ITX29	IT operations	PSE	-	3	3	0	0	3	VII

31.	17ITX30	IT operations Advanced	PSE	-	3	3	0	0	3	VII
32.	17ECX22	Professional Readiness for Innovation, Employability and Entrepreneurship	PSE	-	3	3	0	0	3	VII
33.	17ITX37	Problem Solving Using JAVA	PSE	-	3	3	0	0	3	V

(b)Open Electives			**AICTE Credit Distribution Norm:18**							
1.	17AGZ01	Baking and Confectionery Technology	OE	-	3	3	0	0	3	VII
2.	17AGZ02	Food safety and quality control system	OE	-	3	3	0	0	3	VII
3.	17AGZ03	Farm Mechanization	OE	-	3	3	0	0	3	VIII
4.	17AGZ04	Processing of Fruits and Vegetables	OE	-	3	3	0	0	3	VIII
5.	17CHZ01	Waste Water Treatment	OE	-	3	3	0	0	3	VII
6.	17CHZ02	Piping Engineering	OE	-	3	3	0	0	3	VII
7.	17CHZ03	Process Automation	OE	-	3	3	0	0	3	VII
8.	17CHZ04	Process Instrumentation	OE	-	3	3	0	0	3	VII
9.	17CEZ01	Energy conservation in buildings	OE	-	3	3	0	0	3	VII
10.	17CEZ02	Air Pollution Management	OE	-	3	3	0	0	3	VIII
11.	17CEZ03	Building Services	OE	-	3	3	0	0	3	VIII
12.	17CEZ04	Road Safety Management	OE	-	3	3	0	0	3	VII
13	17CEZ05	Waste Management	OE	-	3	3	0	0	3	VII/VIII
14	17CSZ01	Design Thinking	OE	-	3	3	0	0	3	VII
15	17CSZ02	Digital Marketing	OE	-	3	3	0	0	3	VII
16	17CSZ03	Software Engineering	OE	-	3	3	0	0	3	VIII
17	17CSZ04	Unified Functional Testing	OE	-	3	3	0	0	3	VIII
18	17CSZ05	C Programming	OE	-	3	3	0	0	3	VI
19	17CSZ06	Data Structures	OE	-	3	3	0	0	3	VI
20	17CSZ07	Web Services using Java	OE	-	3	3	0	0	3	VI
21	17ECZ01	Modern wireless communication system	OE	-	3	3	0	0	3	VII
22	17ECZ02	Consumer Electronics	OE	-	3	3	0	0	3	VII
23	17ECZ03	Automotive Electronics	OE	-	3	3	0	0	3	VIII
24	17ECZ04	Electronic Testing	OE	-	3	3	0	0	3	VIII
25	17EEZ01	Renewable Energy Technology	OE	-	3	3	0	0	3	VII
26	17EEZ02	Smart Grid	OE	-	3	3	0	0	3	VII

27	17EEZ03	Energy Auditing, Conservation and Management	OE	-	3	3	0	0	3	VIII
28	17EEZ04	Electrical Machines	OE	-	3	3	0	0	3	VIII
29	17EIZ01	Autotronix	OE	-	3	3	0	0	3	VII
30	17EIZ02	Industrial Automation	OE	-	3	3	0	0	3	VII
31.	17EIZ03	Fiber Optic Sensors	OE	-	3	3	0	0	3	VIII
32.	17EIZ04	Ultrasonic Instrumentation	OE	-	3	3	0	0	3	VIII
33.	17ITZ01	Software Testing Tool	OE	-	3	3	0	0	3	VII
34.	17ITZ02	User Experience	OE	-	3	3	0	0	3	VII
35.	17ITZ03	Developing Mobile Apps	OE	-	3	3	0	0	3	VIII
36.	17ITZ04	Software Project Management	OE	-	3	3	0	0	3	VIII
37.	17ITZ05	Java Programming	OE	-	3	3	0	0	3	VII
38.	17MEZ01	Engineering Ergonomics	OE	-	3	3	0	0	3	VII / VIII
39.	17MEZ02	Energy Audit and Resource Management	OE	-	3	3	0	0	3	VII / VIII
40.	17MEZ03	Electric Vehicle Technology	OE	-	3	3	0	0	3	VII / VIII
41.	17MEZ04	Value Engineering	OE	-	3	3	0	0	3	VII / VIII
42.	17MEZ05	Smart Mobility	OE	-	3	3	0	0	3	VII / VIII
43.	17MEZ06	Smart Sensor Systems	OE	-	3	3	0	0	3	VII / VIII
44	17MYZ01	Mathematical Structures	OE	-	3	3	0	0	3	VII
45	17MYZ02	Optimization Techniques	OE	-	3	3	0	0	3	VII
46	17MYZ03	Statics for Engineers	OE	-	3	3	0	0	3	VII
47	17MYZ04	Statistics for Engineers	OE	-	3	3	0	0	3	VII
48	17PYZ01	Nanomaterials	OE	-	3	3	0	0	3	VII
49	17PYZ02	Nuclear physics and Reactors	OE	-	3	3	0	0	3	VII
50	17PYZ03	Space science and technology	OE	-	3	3	0	0	3	VII
51	17CYZ01	Chemistry for Every Day Life	OE	-	3	3	0	0	3	VII
52	17CYZ02	E - Waste Management	OE	-	3	3	0	0	3	VII
53	17CYZ03	Industrial Chemistry	OE	-	3	3	0	0	3	VII
54	17EYZ01	Communicative Hindi	OE	-	3	3	0	0	3	VII
55	17EYZ02	Fundamentals of German	OE	-	3	3	0	0	3	VII
56	17EYZ03	Basics of Japanese	OE	-	3	3	0	0	3	VII

57	17EYZ04	Employability Enhancement and Analytical Skills	OE	-	3	3	0	0	3	VII
58	17EYX01	Effective Communication	OE	-	3	3	0	0	3	VII
59	17GYZ01	Biology for Engineers	OE	-	3	3	0	0	3	VII
60	17BMZ01	Health care technology	OE	-	3	3	0	0	3	VII
61	17BMZ02	Telemedicine	OE	-	3	3	0	0	3	VII
62	17BMZ03	Epidemiology and Pandemic Management	OE	-	3	3	0	0	3	VII
63	17BMZ04	Medical Ethics	OE	-	3	3	0	0	3	VII
64	17EYZ05	Work place Communication	OE	-	3	3	0	0	3	VII
65	17AIZ01	Fundamentals of artificial intelligence and machine learning	OE	-	3	3	0	0	3	VII
66	17AIZ02	Data science fundamentals	OE	-	3	3	0	0	3	VII
67	17AIZ03	Introduction to Business analytics	OE	-	3	3	0	0	3	VIII
68	17AIZ04	Augmented reality/virtual reality technologies	OE	-	3	3	0	0	3	VII

(D) Employability Enhancement Courses			AICTE Credit Distribution Norm:15							
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17GED03	Personality and Character Development	EEC	-	1	0	0	1	0	VI
2.	17GED06	Comprehension	EEC	ALL CORE SUBJECS	2	0	0	2	0	VII
3.	17ECD01	Project Work-I	EEC	-	8	0	0	8	4	VII
4.	17ECD02	Project Work-II	EEC	17ECD01	16	0	0	16	8	VIII
5.	17GED07	Constitution of India	EEC	-	2	2	0	0	0	VI
6.	17GED08	Essence of Indian traditional knowledge	EEC	-	2	2	0	0	0	V

Honor Degree Courses

Vertical I - Robotics and Sensor Technology

1.	17ECX23	Sensors and sensor circuit design	PSE	-	3	3	0	0	3	-
2.	17ECX24	Sensors and Actuators	PSE	-	3	3	0	0	3	-
3.	17ECX25	Smart sensors for Health care Application	PSE	-	3	3	0	0	3	-
4.	17ECX26	Principles of Robotics	PSE	-	3	3	0	0	3	-
5.	17ECX27	Robotics and Control- Theory and Practice	PSE	-	3	3	0	0	3	-
6.	17ECX28	Programming for Robotics	PSE	-	3	3	0	0	3	-
7.	17ECX29	AI for robotics	PSE	-	3	3	0	0	3	-
8.	17ECX30	Robotics for Industrial applications	PSE	-	3	3	0	0	3	-

Vertical II - Image and Video Processing										
1.	17ECX31	Image Signal Processing	PSE	-	3	3	0	0	3	-
2.	17ECX32	Digital Video Signal Processing	PSE	-	3	3	0	0	3	-
3.	17ECX33	Digital Speech Processing	PSE	-	3	3	0	0	3	-
4.	17ECX34	Pattern Recognition	PSE	-	3	3	0	0	3	-
5.	17ECX35	Medical Image Analysisw	PSE	-	3	3	0	0	3	-
6.	17ECX36	Image and Video Analytics	PSE	-	3	3	0	0	3	-
7.	17ECX37	Computer Vision	PSE	-	3	3	0	0	3	-
8.	17ECX38	Deep Learning for Visual Computing	PSE	-	3	3	0	0	3	-
Minor Degree Courses										
SEMI CONDUCTOR TECHNOLOGIES										
1.	17ECM01	Fundamentals of Semiconductor Devices	OE	-	3	3	0	0	3	-
2.	17ECM02	Semiconductor devices and circuits	OE	-	3	3	0	0	3	-
3.	17ECM03	Semiconductor Device Modelling and Simulation	OE	-	3	3	0	0	3	-
4.	17ECM04	Basic Electronics	OE	-	3	3	0	0	3	-
5.	17ECM05	Semiconductor Optoelectronics	OE	-	3	3	0	0	3	-
6.	17ECM06	Micro Electro Mechanical Systems	OE	-	3	3	0	0	3	-
7.	17ECM07	An introduction to Electronic system Packaging	OE	-	3	3	0	0	3	-
8.	17ECM08	System on a chip Design	OE	-	3	3	0	0	3	-

SUMMARY

S. No.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1.	HS	3	3	0	0	3	0	0	0	9
2.	BS	10	12	3	3	0	0	0	0	28
3.	ES	10	8	6	6	0	0	0	0	30
4.	PC	0	0	13	10	13	13	13	0	62
5.	PSE	0	0	0	3	6	9	3	0	21
6.	OE	0	0	0	0	0	0	3	3	6
7.	EEC	0	0	0	0	0	0	4	8	12
CREDITS TOTAL		23	23	22	22	22	22	23	11	168

17EYA01– PROFESSIONAL ENGLISH – I *(Common to All Branches)*					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		**Course Outcomes**		**Related Program Outcomes**
1.0	To articulate and enunciate words and sentences clearly and efficiently using grammatical structures.	**1.1**	The students will be able to construct clear, grammatically correct sentences using a variety of sentence structures and appropriate vocabulary.	**f,i,j,l**
2.0	To acquire information through listening and apply it to persuade or articulate one's own point of view.	**2.1**	The students will be able to utilize listening skills to articulate one's own point of view in different circumstances.	**f,i,j,l**
3.0	To enable students to express themselves fluently and appropriately in social and professional contexts.	**3.1**	The students will be able to apply appropriate communication skills across settings, purposes, and audiences.	**f,i,j,l**
4.0	To summarize and paraphrase information in a text through reading skills.	**4.1**	The students will be able to distinguish main ideas and supporting details and employ active reading strategies to understand texts at the maximum level.	**f,i,j,l**
5.0	To understand different techniques and contents based on the written communication.	**5.1**	The students will be able to equip themselves with writing skills needed for academic as well as workplace contexts.	**f,i,j,l**

UNIT I – FOCUS ON LANGUAGE	**(6+6)**
Parts of Speech – Articles - Primary Auxiliaries – Modal Auxiliaries - Questions ('Yes/No' & 'Wh' Type) – Negatives - Prepositions – Conjunctions - Tenses (Simple, Continuous, Perfect, Perfect Continuous) - Vocabulary (Synonyms & Antonyms) - Homophones – Homonyms - One Word Substitution.	
UNIT II – LISTENING FOR EFFECTIVENESS	**(6+6)**
Listening to Short Conversations or Monologues - Listening to Verbal and Non-Verbal Communication – Listening to Announcements - Listening and Note-taking – Listening to Telephonic Conversations – Listening to TED/ Ink talks- Intensive listening to fill in the gapped text.	
UNIT III – COMMUNICATION BOOSTERS	**(6+6)**
Introducing Oneself – Exchanging Personal information (Likes & Dislikes) – Talking about Family & Friends - Asking about Routine Actions and Expressing Opinions - Participating in Short Conversations - Situational Talk.	
UNIT IV – PROFESSIONAL READING	**(6+6)**
Skimming – Scanning (Short Texts and Longer Passages) – Inferring Technical Texts – Reading for Interrogation – Reading Newspaper, Advertisements and Interpreting – Practicing Speed Reading - Reading Comprehension (Multiple choice / Short / Open ended Questions) - Gap Filling.	

UNIT V – TECHNICAL CORRESPONDENCE	(6+6)
Seeking Permission for Industrial Visit & In-plant Training – Checklist – Instruction - E-mail Writing - Report Writing (Accident & Survey)	
LIST OF SKILLS ASSESSED IN THE LABORATORY 1. Language Skills. 2. Listening Skills. 3. Speaking Skills. 4. Reading Skills 5. Writing Skills	
	TOTAL (L:30,P:30) = 60 PERIODS

TEXT / REFERENCE BOOKS:

1. Sudharshana, N.P and Saveetha.C. “English for Technical Communication”. New Delhi :Cambridge University Press, 2016.
2. Jackman, Vanessa and Russell, Whitehead. “Cambridge English Business Preliminary Practice Tests”. New Delhi: Oxford University Press, 2016.
3. Rizvi, Ashraf M. “Effective Technical Communication”. New Delhi: Tata McGraw Hill Publishing Company Limited, 2006.
4. Hewings, M. “Advanced English Grammar”. Chennai: Cambridge University Press, 2000.

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17MYB01 - CALCULUS AND SOLID GEOMETRY *(Common to All Branches)*					
		L	**T**	**P**	**C**
		3	**2**	**0**	**4**
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 4**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**			**Related Program Outcomes**
1.0	To develop the use of matrix algebra techniques those are needed by engineers for practical applications.	**1.1**	Apply the concept of orthogonal reduction to diagonalise the given matrix.		**a,b,c,e,g,i,k**
2.0	Use the techniques, Skills and Engineering tools necessary for engineering practice, with Geometric concepts.	**2.1**	Have knowledge about the geometrical aspects of sphere.		**a,b,c,e,f,i,k**
3.0	To improve their ability in solving geometrical applications of differential calculus problems.	**3.1**	Find the radius of curvature, circle of curvature and centre of curvature for a given curve.		**a,b,c,i,k**
4.0	To learn the important role of Mathematical concepts in engineering applications with the functions of several variables.	**4.1**	Classify the maxima and minima for a given function with several variables, through by finding stationary points.		**a,b,c,d,k**
5.0	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.	**5.1**	Demonstrate the use of double and triple integrals to compute area and volume.		**a,b,c,d,f,i,k**

UNIT I - MATRICES	**(9+6)**
Characteristic Equation-Eigen values and Eigen vectors of a matrix –Properties(statement only)- Cayley Hamilton Theorem and its applications- Orthogonal transformation of a symmetric matrix to a diagonal form - Quadratic form- Reduction of a Quadratic form to canonical form by orthogonal transformation.	
UNIT II - ANALYTICAL GEOMETRY OF THREE DIMENSIONS	**(9+6)**
Equation of a Plane –Angle between two planes-Equation of straight lines-Coplanar lines- skew lines- Equation of a sphere – Orthogonal spheres.	
UNIT III - GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	**(9+6)**
Curvature – Curvature in Cartesian co-ordinates-Centre and Radius of curvature-Circle of curvature-Evolutes and Involutes-Envelopes.	
UNIT IV - FUNCTIONS OF SEVERAL VARIABLES	**(9+6)**
Partial derivatives - Euler's theorem on homogeneous function-Jacobian-Maxima and Minima of functions of two variables-Constrained Maxima and Minima by Lagrange's multiplier method.	
UNIT V - MULTIPLE INTEGRALS	**(9+6)**
Double integration in Cartesian Co-ordinates-Change of order of integration-Area as double integral- Triple integration in Cartesian Co-ordinates-Volume as triple integrals.	
TOTAL (L: 45+T:30) = 75 PERIODS	

Note : Simulation of Engineering Problems (Qualitative Analysis) using open source software

TEXT BOOKS:

1. Dr.B.S.Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna publications, 2012.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & sons, 2013.
3. Veerarajan.T, "Engineering Mathematics for Semester I & II ", Third Edition, Tata McGraw Hill,2014.

REFERENCES:

1. N.P.Bali, Manish Goyal, "A text book of Engineering Mathematics: Sem-II", 5th Edition, Laxmi Publications.2011.
2. Kandasamy .P, Thilagavathy .K , Gunavathy .K , "Engineering Mathematics for first Year", 9th Rv. Ed., S.Chand & Co Ltd, 2013.
3. Glyn James, "Advanced Engineering Mathematics", 7thEdition, Wiley India, (2007).

17PYB01- PHYSICS FOR ENGINEERS *(Common to All Branches except CSE and IT)*					
			L	**T**	**P**	**C**
			3	**0**	**0**	**3**
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		**Course Outcomes**		**Related Program outcomes**
1.0	To provide the basic ideas in all the kinds of engineering branches	**1.1**	Acquire knowledge regarding Acoustics and ultrasonic	**a,e**
2.0	To develop the skills of the students in physics under various applications	**2.1**	Applying knowledge in the fields of optics & laser technology	**a,e**
3.0	To cultivate the censor designing ability of the students	**3.1**	Design the sensors using the knowledge of fiber optics	**d,e**
4.0	To provide knowledge in wave and particle physics	**4.1**	Gain the knowledge of wave, particle nature and matter waves	**b,d,e**
5.0	To provide the fundamental knowledge in basics of crystals	**5.1**	Analyze the different kind of crystal structures and crystal growth	**a**

UNIT I – ULTRASONICS & ACOUSTICS	**(9)**
Ultrasonics: Introduction - Properties of Ultrasonics- Magnetostriction and piezo electric methods. Measurement of velocity using acoustic grating- Ultrasonic A B C scan methods - Sonogram. Acoustics: characteristics of musical sound – loudness – Weber – Fechner law – absorption coefficient – reverberation – reverberation time –Factors affecting acoustics of buildings and their remedies.	
UNIT II – OPTICS & LASER TECHNOLOGY	**(9)**
Interference: Air wedge – theory – uses – testing of flat surfaces – determination of thickness of a thin wire. Types of lasers – Nd – YAG laser – CO_2 laser – semiconductor laser (homojunction & hetrojuction). Applications: Determination of particle size using laser - Holography – construction – reconstruction – Lasers in industry (Material Processing) and Medical field (Surgery)	
UNIT III – FIBER OPTICS AND SENSORS	**(9)**
Principle of light transmission through fiber - expression for acceptance angle and numerical aperture – Fabrication of optical fibers- Double crucible method - types of optical fibers (material, refractive Index profile and mode) fiber optic communication system. Splicing – Applications of optical fiber - Sensors- temperature- pressure sensor and displacement sensor Medical Endoscope.	
UNIT IV – WAVE AND PARTICLE PHYSICS	**(9)**
Development of quantum theory – de Broglie wavelength – properties of matter waves - G.P Thomson experiment - Schrödinger's wave equation – time dependent – time independent wave equations – physical significance – applications – particle in a one dimensional potential box - Compton Effect – theory and experimental verification.	
UNIT V – CRYSTALLOGRAPHY	**(9)**
Lattice – unit cell – Bravais lattices – lattice planes – Miller indices – 'd' spacing in cubic lattice – calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC and HCP structures – Crystal growth techniques- solution, melt (Czochralski) and vapour growth techniques(qualitative).	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. V. Rajendran," Engineering Physics", Tata McGraw-Hill, New Delhi, 2011.
2. G Senthilkumar. " Engineering Physics " VRB Publishers, 2011

REFERENCES:

1. P. K. Palanisami, " Physics for Engineers " Vol. 1, SciTech Pub. (India) Pvt. Ltd., Chennai, 2002.
2. M. N. Avadhanulu and P. G. Kshirsagar, "A Textbook of Engineering Physics", S. Chand & Company Ltd., New Delhi, 2005
3. R. K. Gaur and S. L. Gupta, "Engineering Physics", Dhanpat Rai Publishers, New Delhi, 2006.

17CYB02 – APPLIED ELECTRO CHEMISTRY *(Common to ECE,EEE, EIE & BME Branches)*				
L	**T**	**P**	**C**
3	**0**	**0**	**3**

PREREQUISITE : NIL	**QUESTION PATTERN: TYPE - 3**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To understand the principles of water characterization and treatment methods.	**1.1**	Apply knowledge of fundamental principles of chemistry.	**a, f**
2.0	To introduce the basic concepts of electrode potential and batteries.	**2.1**	Define and solve engineering problems, including the utilization of creative and innovative skills .	**a, g**
3.0	To understand the principles and applications of corrosion.	**3.1**	Gain practical experience with chemical process equipment as well as to analyze and interpret data.	**a, c**
4.0	To provide the knowledge polymer chemistry and nanomaterials.	**4.1**	Understand the impact of engineering solutions in a global, economic, environmental and societal content.	**a, c, f**
5.0	To study about the alloys and phase rule.	**5.1**	Understand the management of electronic waste	**a, f**

UNIT I – WATER TECHNOLOGY	**(9)**
Hardness - types - estimation by EDTA method - Domestic water treatment - disinfection methods (chlorination, ozonation and UV treatment) - Boiler troubles (scale, sludge, priming, foaming and caustic embrittlement) -Internal conditioning(carbonate, phosphate and calgon) - External conditioning - demineralization process - desalination - reverse osmosis method.	
UNIT II – ELECTROCHEMISTRY	**(9)**
Electrochemistry - electrode potential - Nernst equation and problems - Reference electrode - standard hydrogen electrode - calomel electrode - potentiometric titration (redox) - conductometric titration (strong acid – strong base) - Batteries - types - lead acid battery – fuel cell – hydrogen and oxygen fuel cell.	
UNIT III – CORROSION SCIENCE	**(9)**
Corrosion - definition – types - chemical and electrochemical corrosion (mechanism) – Galvanic corrosion – Differential aeration corrosion - Pitting corrosion – Factors influencing corrosion- Corrosion control - sacrificial anode method.	
UNIT IV– POLYMERS AND NANOMATERIALS	**(9)**
Polymers - classification, addition, condensation and co polymerization - Plastics - thermoplastics and thermosetting plastics - Engineering plastics - preparation , properties and uses of PVC, teflon, PET and nylon - Polymer processing - compression and injection moulding techniques - Nanomaterials - carbon nanotubes - synthesis and their applications.	
UNIT V – PHASE RULE AND ALLOYS	**(9)**
Phase rule: Introduction, definition of terms with examples, one component system – water system – reduced phase rule – thermal analysis and cooling curves – two component systems – lead silver system – Pattinson process. Alloys : Introduction – Definition – importance and purpose of making of alloys – Ferrous alloys – Nichrome and AlNiCo – heat treatment of steel.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Dr.Ravikrishnan.A, "Engineering chemistry I & Engineering Chemistry II, Sri Krishna Hitech Publishing chem Co. Pvt Ltd., 13th ed., Chennai, 2014.
2. P.C. Jain.and Monica Jain, "Engineering Chemistry",Vol I & II, Dhanpat Rai Pub,Co., New Delhi,15th ed., 2015.

REFERENCES:

1. S.S. Dara, "A Text book of Engineering Chemistry",S.Chand & Co. Ltd., New Delhi, 2014.
2. J. Glynn Henry and Gary W.Heinke ,"Environmental Science and Engineering,"pretice Hall of India,2014.
3. Electroplating, Anodizing and Metal treatment", Hand book, NIIR board, Delhi, 2004.

17CSC02 - PYTHON PROGRAMMING *(Common to CSE,ECE,EEE,EIE , IT& BME Branches)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PREREQUISITE : NIL	**QUESTION PATTERN: TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To gain knowledge about the basics of computer to solve problems	**1.1**	The students will be able to understand the working of computers.	**a,b,c,d,e,h,i,j,k,l**
2.0	To impart the fundamental concepts of Python Programming	**2.1**	The students will be able to understand the basics of Python Programming constructs	**a,b,c,d,e,h,i,j,k,l**
3.0	To gain exposure about string manipulation, list, and tuples	**3.1**	The students will be able to realize the need of strings, list, and tuples	**a,b,c,d,e,h,i,j,k,l**
4.0	To get knowledge about dictionaries, function and modules	**4.1**	The students will be able to design programs involving dictionaries and function.	**a,b,c,d,e,h,i,j,k,l**
5.0	To learn about exception handling.	**5.1**	The students will be able to develop simple programs using file concept and Modules	**a,b,c,d,e,h,i,j,k,l**

UNIT I – BASICS OF COMPUTERS & PROBLEM SOLVING	**(9)**
Computer Basics - Computer organization - Computer Software- Types of software - Software Development steps - Algorithms - Flowchart.	
UNIT II – INTRODUCTION TO PYTHON	**(9)**
History – Features – Execution of python program – Flavors of Python – Comments - Data Types - Built-in data types– Sequences - Literals– Operators – Input and Output Statements - Conditional Statements : if – if-else – Nested if-else – For – While – Nested loops – Break – Continue - pass - assert - return .	
UNIT III – STRINGS, LISTS AND TUPLES	**(9)**
Strings and Characters: Creating – Length – Indexing – Slicing – Repeating – Concatenation – Comparing - Removing Spaces - Finding Sub Strings - Counting Substrings in a String - Strings are Immutable - Replacing a String with another String - Splitting and Joining Strings - Changing Case of a String - Checking Starting and Ending of a String - Formatting the Strings - Working with Characters - Sorting Strings - Searching - Finding Number. Lists: Creating Lists – Updating - Concatenation - Repetition - Methods – Sorting. Tuples: Creating - Accessing – Operations – Functions - Nested Tuples - Inserting Elements, Modifying Elements, Deleting Elements from a Tuples.	
UNIT IV – DICTIONARIES AND FUNCTIONS	**(9)**
Dictionaries: Operations – Methods - Using for Loop with Dictionaries – Sorting the Elements of a Dictionary using Lambdas - Converting Lists and Strings into Dictionary - Passing Dictionaries to Functions - Ordered Dictionaries.	

Functions: Defining – Calling – Returning - Pass by Object Reference – Formal, Actual, Positional, Keyword, Default & Variable Length Arguments - Local and Global Variables - Recursive Functions - Lambdas - Function Decorators.	
UNIT V – FILES AND MODULES	**(9)**
Files - Types of Files - Opening & Closing a File - Working with Text Files Containing Strings - Working with Binary Files - The with Statement - The seek() and tell() Methods - Random Accessing of Binary Files - Random Accessing of Binary Files using mmap - Zipping and Unzipping Files - Working with Directories. - Modules: Importing module – Features – Built in functions.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Dr. R. Nageswara Rao, "Core Python Programming", Dreamtech Press, 2017 Edition.

REFERENCES:

1. A.Kenneth Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2012.
2. Wesley J. Chun, "Core Python Programming", Pearson Education, 2nd ed., 2010.

17ECC01– ELECTRONIC DEVICES *(Common to ECE and BME Branches)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PREREQUISITE : NIL	**QUESTION PATTERN: TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to learn and understand the basics of Semiconductor Diodes.	**1.1**	The Students can be able to design components using basic devices.	**a,b,f,i,k**
2.0	To enable the student to understand the characteristics of Bipolar Junction Transistor.	**2.1**	The Students will be able to analyze characteristics of BJT for various operations.	**a,c,f,j**
3.0	To enable the student to understand the characteristics of Field Effect Transistor.	**3.1**	The Students will be able to understand the characteristics of Field Effect Transistor.	**a,d,i,k**
4.0	To make the students to analyze the operation of Special semiconductor diodes.	**4.1**	The students will be able to analyze the operation of Special semiconductor diodes.	**a,b,f,k**
5.0	To motivate the students to implement the project using Power devices and Display devices.	**5.1**	The Students can implement the project using Power devices and Display devices.	**a,b,c,i,l**

UNIT I – SEMICONDUCTOR DIODE	**(9)**
Semiconductors- Intrinsic and Extrinsic Semiconductors- Energy diagram of Intrinsic and Extrinsic Semiconductor- PN junction diode - Current equations - Diffusion and Drift Current Densities - Forward and Reverse bias characteristics - Switching Characteristics.	
UNIT II – BIPOLAR JUNCTION TRANSISTIOR	**(9)**
NPN and PNP – Junctions - Early effect - Current equations – Input and Output characteristics of CE, CB, CC Configurations - Ebers Moll Model - Transistor as an amplifier.	
UNIT III – FIELD EFFECT TRANSISTORS	**(9)**
JFET – Drain and Transfer Characteristics - Current equations - Pinch off voltage and its significance, MOSFET – Characteristics - Threshold voltage - Channel length modulation - D-MOSFET - E-MOSFET Current equation.	
UNIT IV – SPECIAL SEMICONDUCTOR DEVICES	**(9)**
Metal-Semiconductor Junction – MESFET – Schottky barrier diode - Zener diode - Varactor diode – Tunnel diode – PIN diode - LASER diode - LDR.	
UNIT V – POWER DEVICES AND DISPLAY DEVICES	**(9)**
UJT - SCR - Diac - Triac - Power BJT - Power MOSFET - DMOS – VMOS, LED – LCD - Photo transistor - OptoCoupler - Solar cell - CCD.	

TOTAL (L: 45) = 45 PERIODS

TEXT BOOK:

1. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, “Electronic Devices and Circuits”,Tata McGrawHill Third Edition (2013).

REFERENCES:

1. David A. Bell, “Electronic Devices and Circuits”, Oxford University Press, Fifth Edition, 2008.
2. Jacob Millman & Christos C. Halkias, “Electronic Devices and Circuits”, McGraw Hill, 2 nd Edition, 2007.
3. R.L. Boylestad & L. Nashelsky, “Electronic Devices and Circuit Theory”, PHI Learning Private Limited, Ninth Edition, 2008.

17CSP02 -PYTHON PROGRAMMING LABORATORY

(Common to CSE,ECE,EEE,EIE ,IT & BME Branches)

L	T	P	C
0	0	4	2

PRE REQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To impart the fundamental concepts of Python Programming	**1.1**	The students will be able to understand the basics of Python Programming constructs	**a,c,j**
2.0	To learn the operator concepts of Python Programming	**2.1**	The students will be able to understand the various operators of Python Programming.	**a,b,k**
3.0	To gain exposure about string manipulation, list, and tuples	**3.1**	The students will be able to realize the need of string manipulation, list, and tuples	**a,b,c,i,k**
4.0	To get knowledge about dictionaries, function and modules	**4.1**	The students will be able to design programs involving dictionaries, function and modules	**a,b,c,i,k**
5.0	To learn about exception handling	**5.1**	The students will be able to develop simple programs with exception handling	**a,b,e,i**

Python-Programming

1. Program using Operators
2. Program using Conditional Statements
3. Program using Looping
4. Program using Strings
5. Program using Lists
6. Program using Dictionaries
7. Program using Tuples
8. Program using Functions
9. Program using File handling
10. Program using Modules

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

Hardware

- LAN System with 33 nodes (OR) Standalone PCs – 33 Nos, Printers – 3 Nos.

Software

- OS – Windows / UNIX Clone
- Open Source Software – Python

TOTAL (P:60) = 60 PERIODS

17GYP02 ENGINEERING PRACTICES LABORATORY *(Common to All Branches)*				
L	**T**	**P**	**C**
0	**0**	**4**	**2**

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To provide hands on training on various basic engineering practices in Civil Engineering	**1.1**	The students will be able to understand various civil engineering practices like plumbing, carpentry and relevant tools	**a, d, f, i, k, l**
2.0	To provide hands on training on various basic engineering practices in Mechanical Engineering	**2.1**	The students will be able to understand various manufacturing processes like welding, machining and sheet metal work	**a, d, f, i, k, l**
3.0	To understand the basic working principle of electric components	**3.1**	The students will be able to do residential house wiring and Measure energy and resistance to earth of an electrical equipment	**a,e,f,h**
4.0	To understand the basic working principle of electronic components	**4.1**	The students will be able to perform the assembling and testing of the PCB based electronic circuits.	**a,j,k,l**
5.0	To develop the skill to make / operate/utilize the simple engineering components	**5.1**	The students will be able to make / operate / utilize the simple engineering components.	**e, j**

GROUP-A (MECHANICAL AND CIVIL ENGINEERING)

I - CIVIL ENGINEERING PRACTICE **(15)**

Buildings:

a. Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects

Plumbing Works:

a. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings
b. Study of pipe connections requirements for pumps and turbines
c. Preparation of plumbing line sketches for water supply and sewage works
d. Hands-on-exercise:

   Basic pipe connections - Mixed pipe material connection - Pipe connections with different joining components
e. Demonstration of plumbing requirements of high-rise buildings

Carpentry using Power Tools only:

a. Study of the joints in roofs, doors, windows and furniture
b. Hands-on-exercise: Planning, Tee joints.

II - MECHANICAL ENGINEERING PRACTICE **(15)**

Welding:

a. Preparation of edges for welding and study of welding symbols
b. Arc welding- butt joints, lap joints and tee joints
c. Gas welding
d. Study of standard size of bars, rods, sections, sheet metals

e. Study of work piece types and parameters of welding such as welding current, air gap, filler metal	
Basic Machining: a. Facing & Plain turning b. Drilling Practice c. Study of different types of screw drivers, screws, bolts and nuts	
Sheet Metal Work: a. Model making using bending and forming - Trays, cone b. Study of thickness gauges, wire gauges	
GROUP - B (ELECTRICAL AND ELECTRONICS)	
I - ELECTRICAL ENGINEERING PRACTICE	**(15)**
a. Residential house wiring using switches, fuse, indicator, lamp and energy meter b. Fluorescent lamp wiring c. Stair case wiring d. Measurement of electrical quantities - voltage, current, power& power factor in RLC circuit e. Measurement of energy using single phase energy meter f. Measurement of resistance to earth of electrical equipment.	
II - ELECTRONICS ENGINEERING PRACTICE	**(15)**
a. Study of Electronic components - Resistor (Colour coding), Inductor, Capacitor. b. Measurement of AC signal parameter (peak-peak, RMS period, frequency) using CRO. c. Study of logic gates AND, OR, XOR and NOT. d. Study of Clock Signal. e. Soldering practice -Components Devices and Circuits - Using general purpose PCB. f. Study of Half Wave Rectifier (HWR) and Full Wave Rectifier (FWR). g. Study of Telephone, FM Radio and Cell Phone.	
TOTAL(P:60): 60 PERIODS	

17GEP01 - Personal Values *(Common to All Branches)*					
		L	**T**	**P**	**C**
		0	**0**	**2**	**0**
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To make students to learn individual in knowing them self	**1.1**	Become an individual in knowing the self	**a, f**	
2.0	To enable the student to understand Gratitude, Truthfulness, Punctuality, Cleanliness & fitness.	**2.1**	Acquire and express Gratitude, Truthfulness, Punctuality, Cleanliness &fitness.	**a, g**	
3.0	To enable the student to understand physical exercise and breathing techniques	**3.1**	Practice simple physical exercise and breathing techniques	**a, c**	
4.0	To make the students to Yoga asana which will enhance the quality of life.	**4.1**	Practice Yoga asana which will enhance the quality of life.	**a, c, f**	
5.0	To motivate the students to Practice Meditation and get benefited	**5.1**	Practice Meditation and get benefited.	**a, f**	

Values through Practical activities:

1.Knowing the self

Introduction to value education - Need & importance of Value education – Knowing the self – realization of human life – animal instinct vs sixth sense.

2. **Mental Health**

Evolution of senses – functioning steps of human mind – Body and Mind coordination - Analysis of thoughts – moralization of desires– autosuggestions – power of positive affirmations. – Meditation and its benefits.

3.Physical Health

Physical body constitution– Types of food - effects of food on body and mind – healthy eating habits – food as medicine– self healing techniques.

4.Core value Self love& Self care:

Gratitude - Happiness - Optimistic –Enthusiasm – Simplicity – Punctual - Self Control - Cleanliness & personal hygiene - Freedom from belief systems.

5.Fitness

Simplified physical exercises – Sun salutation - Lung strengthening practices: Naadi suddhi pranayama – Silent sitting and listening to nature – Meditation.

TOTAL(P:30): 30 PERIODS

REFERENCES:

1. Know yourself -socrates - pdf format at www.au.af.mil/au/awc/awcgate/army/rotc_self-aware.pdf.
2. Steps to knowledge: the book of inner knowing-pdf format at www.newmessage.org/wp content/uploads/pdfs/books/stk_nkl_v1.5.pdf.
3. Promoting mental health - world health organization -pdf.
4. www.who.int/mental_health/evidence/mh_promotion_book.pdf.
5. Learning to be: a holistic and integrated approach to values-unesco pdf format at www.unesdoc.unesco.org/images/0012/001279/127914e.pdf.
6. Personality development by swami Vivekananda -www.estudantedavedanta.net/personality- development.pdf.

17EYA02 – PROFESSIONAL ENGLISH – II (*Common to All Branches)*				
	L	**T**	**P**	**C**
	2	**0**	**2**	**3**
PREREQUISITE : 17EYA01	**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To enable students to get familiar with words, phrases and sentences relevant to the immediate communication tasks.	**1.1**	The students will be able to communicate using a variety of sentence structures and appropriate vocabulary.	**f,i,j,l**
2.0	To help students to develop their listening skills and comprehend them by asking questions.	**2.1**	The students will be able to comprehend conversations and short talks delivered in English and respond accordingly.	**f,i,j,l**
3.0	To enhance students' speaking skills by making them to participate in Technical Presentation, Group Discussion, etc.	**3.1**	The students will be able to speak appropriately and effectively in various situations.	**f,i,j,l**
4.0	To inculcate reading habit and to develop effective reading skills.	**4.1**	The students will be able to employ active reading strategies to understand texts at the maximum level.	**f,i,j,l**
5.0	To foster the ability to write convincing Job Application and effective Formal Letters.	**5.1**	The students will be able to equip themselves with writing formal letters and winning Job Application.	**f,i,j,l**

UNIT I - LANGUAGE DEVELOPMENT	**(6+6)**
Vocabulary (Prefixes & Suffixes) - Active Voice and Passive Voice - Impersonal Passive Voice – Conditional Clauses – Subject - Verb Agreement - Direct and Indirect Speech - Idioms and Phrases - Discourse Markers - Error Spotting.	
UNIT II – LISTENING COMPREHENSION	**(6+6)**
Listening for Specific Information and Match / Choose / Fill in the texts - Short Films, News, Biographies, Roles and Responsibilities in Corporate, Funny Shows – Listening to Iconic Speeches and making notes – Listening to Interviews.	
UNIT III – ACQUISITION OF ORAL SKILLS	**(6+6)**
Describing a Person - Making Plans – Asking for and Giving Directions - Talking about Places - Talking over Phone – Narrating Incidents – Introduction to Technical Presentation - Story Telling – Group Discussion.	
UNIT IV – READING NUANCES	**(6+6)**
Intensive Reading – Extensive Reading – Finding key information in a given text - Reading and Understanding Technical Articles - Reading and Interpreting Visual Materials.	
UNIT V – EXTENDED WRITING	**(6+6)**
Job Application with Resume – Recommendation – Inviting Dignitaries - Accepting & Declining Invitation - Paragraph Writing (Topics and Images).	

LIST OF SKILLS ASSESSED IN THE LABORATORY

1. Language Skills.
2. Listening Skills.
3. Speaking Skills.
4. Reading Skills
5. Writing Skills

TOTAL (L:30, P:30) = 60 PERIODS

TEXT / REFERENCE BOOKS:

1. Kumar, Suresh. E. "Engineering English". Orient Blackswan : Hyderabad, 2015.
2. Raman, Meenakshi and Sangeetha Sharma. "Technical Communication Principles and Practice". Oxford University Press: New Delhi, 2014.
3. Board of Editors. "Fluency in English – A Course Book for Engineering and Technology".Orient Blackswan: Hyderabad, 2016.
4. Comfort, Jeremy, et al. "Speaking Effectively: Developing Speaking Skills for Business English". Cambridge University Press: Cambridge, 2011.

17MYB02 – COMPLEX ANALYSIS AND LAPLACE TRANSFORMS *(Common to All branches)*					
			L	**T**	**P**	**C**
			3	**2**	**0**	**4**
PREREQUISITE : 17MYB01		**QUESTION PATTERN : TYPE - 4**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To expose the concepts of differential equations.	**1.1**	Predict the suitable method to solve second and higher order differential equations		**a, b, c, d, f, i, k**
2.0	To communicate the problem solutions using correct Mathematical terminology of vector calculus.	**2.1**	Apply the concepts of Differentiation and Integration to Vectors.		**a, b, c, f, g, k**
3.0	Apply rigorous and analytic approach to analyse the conformal mapping.	**3.1**	Compute an analytic function, when its real or imaginary part is known.		**a, b, c, d, e, i, k**
4.0	Acquiring the knowledge of evaluating contour integrals using residue theorem.	**4.1**	Identify the Singularities and its corresponding Residues for the given function.		**a, b, c, d, e, k**
5.0	Apply the concepts of Laplace transforms and its applications to various problems related to Engineering.	**5.1**	Predict a suitable method to evaluate the Contour integration.		**a, b, c, d, e, f, i, k**

UNIT I - ORDINARY DIFFERENTIAL EQUATIONS	**(9+6)**
Higher order linear differential equations with constant coefficients - method of variation of parameters - Cauchy's and Legendre's linear equations	
UNIT II - VECTOR CALCULUS	**(9+6)**
Gradient and Directional derivative -Divergence and Curl – Irrotational,solenoidal and scalar potential –Line integral over a plane curve-Surface Integral and Volume Integral-Green's theorem in a plane-Gauss divergence theorem and Stokes Theorem (Excluding Proofs)-Simple Applications Involving Square, Rectangles, Cube and Parallelopiped.	
UNIT III- ANALYTIC FUNCTIONS	**(9+6)**
Functions of a complex variable-Analytic functions– Necessary and sufficient conditions of Cauchy's -Riemann Equations in Cartesian Coordinates (Excluding Proofs) – Properties of Analytic Functions – Harmonic conjugate – Construction of an analytic function by Milne's Thomson Method– Conformal mapping :w = c+z , cz, 1/z and Bilinear Transformation.	
UNIT IV - COMPLEX INTEGRATION	**(9+6)**
Statement and Simple applications of Cauchy's integral theorem and Cauchy's integral formula(Excluding Proofs) – Taylor's and Laurent's Series Expansions - Singularities - Residues – Cauchy's Residue theorem (Statement only) – Evaluation of contour integration over unit circle and semi circle (Excluding poles on Real axis).	
UNIT V- LAPLACE TRANSFORM	**(9+6)**
Condition for existence - Transforms of Elementary functions –Basic Properties- First & Second Shifting Theorems (Statement only) –Transforms of derivatives and integrals- Transform of periodic functions - Initial and Final value Theorems. Inverse Laplace transforms -Convolution theorem (Statement only) –Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms.	
TOTAL (L: 45+T:30) = 75 PERIODS	

Note : Simulation of Engineering Problems (Qualitative Analysis) using open source software

TEXTBOOKS:

1. Dr.B.S.Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna publications, 2012
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley and sons, 2013
3. Veerarajan.T, "Engineering Mathematics for Semester I and II", 3rd Edition, Tata McGraw Hill, 2014

REFERENCES:

1. N.P.Bali and Manish Goyal, "A text book of Engineering Mathematics : Semester-II", 5th Edition, Laxmi Publications, 2011
2. Kandasamy .P, Thilagavathy .K and Gunavathy .K, "Engineering Mathematics for first Year", 9th Rv. Ed., S.Chand and Co Ltd, 2013
3. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Wiley India, 2007.

17PYB05 – PHYSICS OF SOLIDS *(Common to EEE, ECE and EIE branches)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PREREQUISITE: 17PYB01	**QUESTION PATTERN : TYPE - 1**				

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		**Course Outcomes**		**Related Program outcomes**
1.0	To provide the basic ideas in electrical conduction, conductors, semiconductors, dielectrics and nano technology	**1.1**	Acquire knowledge about conductors, semiconductors and super conductors.	**a,b**
2.0	To understand the fundamental concepts on solid state physics	**2.1**	Distinguish between conductors, semiconductors and super conductors.	**a,b**
3.0	To provide the basic knowledge in dielectric materials and fabrication of integrated circuits	**3.1**	Understand the dielectrics and its applications.	**a,e**
4.0	To update the recent development in modern engineering materials	**4.1**	Get the knowledge about fabrication of integrated circuits.	**a,e,f**
5.0	To update the recent development in modern engineering materials.	**5.1**	Know of recent trends in nanotechnology.	**d,e,f**

UNIT I - CONDUCTING MATERIALS	**(9)**
Electron theories of conductivity - postulates of classical free electron theory- derivation of electrical conductivity of metals (Drude- Lorentz theory) - merits and demerits. Derivation of thermal conductivity – Weidman-Franz law-verification. Fermi energy - Importance of fermi energy - Fermi-Dirac distribution function and its variation with temperature - density of energy states- calculation of density of electron.	
UNIT II - SEMICONDUCTING MATERIALS & SUPERCONDUCTING MATERIALS	**(9)**
SEMICONDUCTORS: Elemental and compound semiconductors - Intrinsic semiconductor – carrier concentration derivation – variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors (qualitative) – variation of Fermi level with temperature and impurity concentration – Hall effect – determination of Hall coefficient – Applications. **SUPERCONDUCTIVITY:** Properties - Types of super conductors – BCS theory of superconductivity – Applications of superconductors – SQUID, cryotron, magnetic levitation.	
UNIT III -DIELECTRIC MATERIALS	**(9)**
Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.	
UNIT IV -FABRICATION PROCESS USING SEMICONDUCTOR AND DIELECTRICS	**(9)**
Bulk crystal growth-Epitaxial growth- masking and etching-diffusion of impurities-selective diffusion-formation of PN junction- resistors- capacitors-inductors-isolation methods-metal semiconductor contact. Introduction to integrated circuit, monolithic and hybrid circuits, thin film and thick film technology. Definition of LSI, MSI, VLSI circuits.	

UNIT V -MODERN ENGINEERING MATERIALS &NANOTECHNOLOGY	(9)
Metallic glasses: preparation, properties and applications. Shape Memory Mlloys (SMA): Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA. Nano materials: synthesis –plasma arcing – chemical vapour deposition – sol gel – electrode position – ball milling - properties of nano particles and applications. Carbon nano tubes: fabrication – arc method – pulsed laser deposition –structure – properties and application.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. V.Rajendran, "Engineering Physics", Tata McGraw-Hill. New Delhi.2011.
2. P.K.Palanisami, "Physics for Engineers-Volume I", Scitech publications (India) Pvt.Ltd, Chennai, 2002

REFERENCES:

1. Jacob Millman, Charistos C Halkilas, SatyabrataJit "Electronic Devices & Circuits", Tata McGraw Hill Education Private Limited, 2010, Third Edition.
2. Ben G.Streetman, Sanjay Banerjee, "Solid State Electronic Devices", Pearson Education, 2006, Fifth Edition.
3. G.Senthil Kumar, N.Iyandurai, "Physics-II", VRB Publishers, 2005-2006, Revised Edition.
4. S.O. Pillai, "Solid State Physics", New Age International Publications, New Delhi, 2010.
5. Avadhanulu.M.N, Kshirsagar.P.G, "A Text book of Engineering Physics", S.Chand, 2011.

17CYB03 ENVIRONMENTAL SCIENCE *(Common to All Branches)*					
		L	T	P	C
		3	0	0	3
PREREQUISITE: NIL		**QUESTION PATTERN : TYPE - 3**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To understand the constitutes of the environment.	**1.1**	Design a system, component, or process to meet desired needs.		**c, g**
2.0	The students should be conversant with valuable resources	**2.1**	Identify, formulate, and solve environmental engineering problems		**a, c, g**
3.0	To know about the role of a human being in maintaining a clean environment.	**3.1**	Understand the professional and ethical responsibility as related to the practice of environmental engineering and the impact of engineering solutions in a global context.		**c, f, g**
4.0	To maintain ecological balance and preserve bio-diversity.	**4.1**	Use the techniques, skills, and modern engineering tools necessary for environmental engineering practice.		**a, c**
5.0	To get knowledge about the conservation of environment for the future generation.	**5.1**	Acquire the knowledge of information technology in environmental science.		**a, f, g**

UNIT I : INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES	**(9)**
Environment: Scope – importance - need for public awareness - Forest resources - Use-over exploitation-deforestation - Water resources - use-over utilization of surface and ground water - conflicts over water - Mineral resources - use-exploitation-environmental effects of extracting and using mineral resources - Food resources - world food problems changes caused by agriculture - Effects of modern agriculture - fertilizer- pesticide problems - Energy resources - Renewable energy sources - solar energy - wind energy. Land resources - land degradation - soil erosion - Role of an individual in conservation of natural resources.	
UNIT- II ECOSYSTEMS AND BIODIVERSITY	**(9)**
Concepts of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Food chains- food webs - types of ecosystem - structure and functions of forest ecosystem and river ecosystem – Biodiversity - value of biodiversity - consumptive use-productive use - social values - ethical values - aesthetic values - Hotspots of biodiversity -Threats to biodiversity - Habitat loss - poaching of wildlife and man wildlife conflicts- Conservation of biodiversity - In-situ and Ex-situ conservation of biodiversity.	
UNIT III : ENVIRONMENTAL POLLUTION	**(9)**
Pollution: Causes - effects and control measures of Air pollution - Water pollution - Soil pollution and Noise pollution - Solid waste management - Causes - effects -control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster managements - Floods - cyclone- landslides.	
UNIT IV : SOCIAL ISSUES AND THE ENVIRONMENT	**(9)**
Water conservation - rain water harvesting - global warming - acid rain - ozone layer depletion - Environment protection act - Air (Prevention and control of pollution) Act - Water (prevention and control of pollution) Act - Green Chemistry – Principle of Green chemistry – Application of Green chemistry.	

UNIT V : HUMAN POPULATION AND THE ENVIRONMENT	(9)
Population growth - variation among nations - Population explosion - Family welfare programme - Human rights - HIV/AIDS – Human health and environment - women and child welfare - Role of information technology in environment and human health.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Anubha Kaushik and C.P. Kaushik, Environmental Science and Engineering, New Age International Publishers, New Delhi (2015).
2. Dr. A.Ravikrishan, Envrionmental Science and Engineering., Sri Krishna Hitech Publishing co. Pvt. Ltd., Chennai,12th Edition (2016).

REFERENCES:

1. Masters, Gilbert M, "Introduction to Environmental Engineering and Science", Second Edition, Pearson Education, New Delhi (2012).
2. Santosh Kumar Garg, Rajeshwari garg, smf Ranjni Garg "Ecological and Environmental Studies" Khanna Publishers, Nai Sarak, Delhi (2014).
3. Miller T.G. Jr., "Environmental Science", Tenth Edition, Wadsworth Publishing Co. (2015).

17MEC01 – ENGINEERING GRAPHICS *(Common to All Branches except CSE and IT)*					
		L	**T**	**P**	**C**
		2	**2**	**0**	**3**
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 2**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To gain knowledge about conic sections and plane curves.	**1.1**	The Students can be able to construct conic sections and special curves of required specifications.	**a, c, d, e, i, k, l**
2.0	To learn the concept of first angle projection of points, lines and plane	**2.1**	The Students can be able to apply the concept of first angle projection to create project of straight lines, planes, solids and section of solids.	**a, c, d, i, k, l**
3.0	To understand and familiarize with the projection of solids	**3.1**	The Students can be able to develop a surface drawing of a solid model with given dimensions.	**a, c, d, e, i, k, l**
4.0	To learn the concept of sectioning of solids and developing the surfaces	**4.1**	The Students can be able to build orthographic, isometric projections of a three dimensional object.	**a, c, d, i, k, l**
5.0	To understand the orthographic, isometric and perspective projections of three dimensional objects	**5.1**	The Students can be able to make use of the knowledge of engineering drawing to create physical models.	**a, c, d, i, k, l**

CONCEPTS AND CONVENTIONS:

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

UNIT I - PLANE CURVES	**(6+6)**

Basic Geometrical constructions, Curves used in engineering practices - Conics - Construction of ellipse, parabola and hyperbola by eccentricity method - Construction of cycloid - construction of involutes of square and circle - Drawing of tangents and normal to the above curves - Theory of Projection - Principle of Multi-view Orthographic projection - Profile plane and Side views - Multiple views - Representation of Three Dimensional objects - Layout of views

UNIT II - FIRST ANGLE PROJECTION OF POINTS, LINES AND PLANE	**(6+6)**

Principal planes - First angle projection - Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method - Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III - PROJECTION OF SOLIDS	**(6+6)**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method

UNIT IV - SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	(6+6)
Sectioning of solids (Prism, Cube, Pyramid, Cylinder and 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 lateral surfaces of simple and sectioned solids - Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.	
UNIT V - ISOMETRIC, ORTHOGRAPHIC AND PERSPECTIVE PROJECTIONS	**(6+6)**
Principles of isometric projection - Isometric scale - Isometric projections of lines, plane figures, simple solids and truncated solids - Prisms, pyramids, cylinders, cones - combination of two solid objects in simple vertical positions - Free hand sketching of Orthographic views from Isometric views of objects. Perspective projection of simple solids - Cube, Prisms and pyramids by visual ray method	
TOTAL (L:30+T:30) = 60 PERIODS	

TEXT BOOKS:

1. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2013.
2. N.S Parthasarathy and Vela Murali, "Engineering Drawing", Oxford University Press, 2015.

REFERENCES:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. K.R.Gopalakrishna., "Engineering Drawing" (Vol I&II combined) Subhas Stores, Bangalore, 2007
3. K. V.Natarajan, "A text book of Engineering Graphics", 28th Edition, Dhanalakshmi Publishers, Chennai, 2015.
4. Dr. M. Saravanan, Dr. M. Arockia Jaswin and J. Bensam Raj, "Engineering Graphics", Tri Sea Publications.
5. Luzzader, Warren.J., and Duff, John M, "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005
6. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009

INSTRUMENT: ***Use of Mini drafter is compulsory***

Special points applicable to End Semester Examinations on Engineering Graphics:

1. The answer paper shall be of A3 size drawing sheets.
2. Minimum one question and not more than two questions from a unit.
3. Question paper consists of Part A and Part B.
4. Part A: One compulsory question carries 20 marks from any one of five units.
5. Part B: 4 out of 8 open choice questions carry 20 marks each.

17ECC03- CIRCUIT THEORY *(Common to ECE & BME Branches)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE - 3**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to learn and understand the basics of Electrical circuits.	**1.1**	The Students can apply the Ohm's law and Kirchhoff's law and investigates the behavior of electric circuits by analytical techniques.	**a,b,f,i,k**
2.0	To enable the student to Evaluate the voltage, current of electric circuit using Graph theory techniques	**2.1**	The Students will be able to Evaluate the voltage, current of electric circuit using Graph theory techniques	**a,c,f,j**
3.0	To enable the student to Design simple network for the complex network by exploring circuit theorems.	**3.1**	The Students will be able to Design simple network for the complex network by exploring circuit theorems.	**a,d,i,k**
4.0	To motivate the students to implement the project using transient response of DC circuits.	**4.1**	The students will be able to Design and test the dc and ac transient circuits using test signals.	**a,b,f,k**
5.0	To make the students to design the resonance circuit and coupled circuits.	**5.1**	Design and test circuit for a desired cut off frequency using resonant and coupled circuits.	**a,b,c,i,l**

UNIT I - BASICS OF CIRCUIT ANALYSIS	**(9)**
Basic components and electric circuits, voltage and current laws, Resistors and Capacitors – series and parallel circuits, Basic mesh and nodal analysis, source transformation techniques-Star delta transformation techniques.	
UNIT II -NETWORK THEOREMS FOR DC CIRCUITS	**(9)**
Network Reduction: Voltage and Current Division, - Thevenin's theorem - Norton's theorem- Super position theorem- Maximum power transfer theorem- Reciprocity theorem.	
UNIT III- NETWORK THEOREMS FOR AC CIRCUITS	**(9)**
Impedance and Admittance for R, L and C elements, Thevenin's theorem - Norton's theorem- Super position theorem- Maximum power transfer theorem- Reciprocity theorem.	
UNIT IV -TRANSIENTS	**(9)**
Differential equations / Laplace Transform - Steady state and transient response: DC response of RL, RC and RLC circuit - Sinusoidal response of RL, RC and RLC circuits.	
UNIT V-RESONANCE AND COUPLED CIRCUITS	**(9)**
Resonance: Natural frequency and Damping Ratio - Series Resonance - Parallel Resonance-Quality Factor. Coupled Circuits: Self-inductance- Mutual inductance, Dot conversion-Coupling Coefficient. Tuned Circuits-Single Tuned circuits.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis," 8th edition., Tata McGraw Hill publishers, New Delhi, 2013.

REFERENCES :

1. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis,” Tata McGraw Hill, 2007.
2. Chakrabati A, “Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
3. Nageswara Rao.T, “Circuit Theory”, A.R. Publications, Chennai, 2014.
4. Joseph Edminister and MahmoodNahri, Theory and Problems of Electric Circuits Tata McGraw- Hill, 2008.

17GYP01 - PHYSICS AND CHEMISTRY LABORATORY *(Common to All Branches Except CSE and IT)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**
PREREQUISITE: NIL				

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To provide the basic practical exposure to all the engineering and technological streams in the field of physics.	**1.1**	Acquire the fundamental knowledge in optics such as interference, Diffraction and Understand about the spectral instruments etc	**a,b,d,g,l**
2.0	To provide the basic practical exposure to all the engineering and technological streams in the field of chemistry	**2.1**	Gain the basic knowledge about handling the laser light and Identify the basic parameters of an optical fibre.	**a,b,d,g**
3.0	The students are able to know about the water containing impurities and some physical parameters	**3.1**	Analyze the properties of matter with sound waves.	**a,b,d**
4.0	To gain the knowledge about light, sound, laser, fiber optics and magnetism	**4.1**	Apply knowledge of measurement of hardness producing ions, chloride, alkalinity, DO, conductance, EMF and pH	**a,b,d,g**
5.0	To develop the knowledge of conductometric titration and viscometry	**5.1**	Understand the impact of water quality and solve engineering problems.	**a,b,d,g**

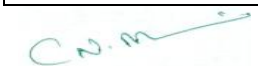
Physics Laboratory (Any Five – Branch specific)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

Chemistry Laboratory (Any Five)

1 Determination of total, temporary & permanent hardness of water by EDTA method.
2 Determination of alkalinity in water sample.
3 Determination of chloride content of water sample by argentometric method.
4 Conductometric titration of strong acid vs strong base.
5 Estimation of iron content of the given solution using potentiometer.
6 Determination of strength of given hydrochloric acid using pH meter
7 Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
8 Estimation of iron content of the water sample using spectrophotometer

TOTAL(P:60): 60 PERIODS



17ECP01 – CIRCUITS AND DEVICES LABORATORY *(Common to ECE & BME Branches)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PREREQUISITE : 17ECC01– ELECTRONIC DEVICES

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to learn and practice the basics of Semiconductor Diodes.	**1.1**	The Students can be able to analyze the characteristics of diodes and transistors.	**a,b,e,k**
2.0	To enable the student to analyze the characteristics of Bipolar Junction Transistor and Field Effect Transistor.	**2.1**	The Students will be able to evaluate the characteristics of electronic devices such as FET, UJT and SCR etc based on their operations.	**a,b,f,k**
3.0	To provide the student with practice in the experimental setup of basic electronic circuits.	**3.1**	The Students will be able to verify the characteristics of clipper and clamper.	**a,j,l**
4.0	To make the students to learn and practice with measurement of electrical networks.	**4.1**	The students will be able to verify the theorems such as Thevenin's theorem, Norton theorems etc.	**b,d**
5.0	To motivate the students to implement the project using electronic devices and display devices.	**5.1**	The Students will be able to measure the voltage and frequency using resonance circuits.	**c,g**

LIST OF EXPERIMENTS:

1. Characteristics of PN junction diode and Zener diode
2. Input-Output characteristics of common emitter configuration.
3. Input-Output characteristics of common base configuration.
4. FET characteristics.
5. UJT characteristics.
6. SCR characteristics.
7. Verification of Thevenin's theorem.
8. Verification of Norton's theorem.
9. Verification of KVL, KCL.
10. Verification of super position theorem and reciprocity theorem.
11. Determination of resonance frequency of series and parallel circuits.

TOTAL (P: 60) = 60 PERIODS

17GEP02- INTER PERSONAL VALUES *(Common to All Branches)*					
		L	T	P	C
		0	0	2	0
PREREQUISITE: 17GEP01					
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To know interpersonal values.	**1.1**	Develop a healthy relationship & harmony with others.	**a, f**	
2.0	To train the students to maneuver their temperaments.	**2.1**	Practice respecting every human being.	**a, g**	
3.0	To achieve the mentality of appreciating core values of a person.	**3.1**	Practice to eradicate negative temperaments.	**a, c**	
4.0	To analyze the roots of problems and develop a positive attitude about the life.	**4.1**	Acquire Respect, Honesty, Empathy, Forgiveness and Equality.	**a, c, f**	
5.0	To understand the effects of physical activities on mental health.	**5.1**	Practice Exercises and Meditation to lead a healthy life and Manage the cognitive abilities of an Individual.	**a, f**	

UNIT II - INTRODUCTION	**(6)**
Introduction to interpersonal values – Developing harmony with others –Healthy relationship – Need & importance of interpersonal values for dealing with others and team - Effective communication with others.	
UNIT II - MANEUVERING THE TEMPERAMENTS	**(6)**
From Greed To Contentment - Anger To Tolerance -Miserliness To Charity – Ego To Equality - Vengeance To Forgiveness.	
UNIT III - CORE VALUE	**(6)**
Truthfulness **-** Honesty –Helping–Friendship – Brotherhood – Tolerance –Caring & Sharing – Forgiveness – Charity – Sympathy — Generosity – Brotherhood -Adaptability.	
UNIT IV – PATHWAY TO BLISSFUL LIFE	**(6)**
Signs of anger – Root cause – Chain reaction – Evil effects on Body and Mind – Analyzing roots of worries – Techniques to eradicate worries.	
UNIT V - THERAPEUTIC MEASURES	**(6)**
Spine strengthening exercises - Nero muscular breathing exercises - Laughing therapy - Mindfulness meditation.	
TOTAL(P:30): 30 PERIODS	

REFERENCES:

1. Interpersonal Skills Tutorial (Pdf Version) – TutorialsPoint www.tutorialspoint.com/interpersonal_skills/interpersonal_skills_tutorial.pdf
2. Interpersonal relationships at work - Ki Open Archive – Karolinska www.publications.ki.se/xmlui/bitstream/handle/10616/39545/thesis.pdf?sequence=1
3. Values education for peace, human rights, democracy – UNESCO. www.unesdoc.unesco.org/images/0011/001143/114357eo.pdf
4. Maneuvering Of Six Temperaments - Vethathiri Maharishi. www.ijhssi.org/papers/v5(5)/F0505034036.pdf
5. The Bliss of inner fire: Heart practice of the six. – Wisdom Publications - www.wisdompubs.org/sites/.../Bliss%20of%20Inner%20Fire%20Book%20Preview.pd

17MYB05 -TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS (*Common to BME,EEE,ECE and E&I Branches)*					
		L	**T**	**P**	**C**
		2	**2**	**0**	**3**
PREREQUISITE : 17MYB02	**QUESTION PATTERN : TYPE -4**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		**Course Outcomes**		**Related Program outcomes**
1.0	To understand the concept of Fourier Series and enhance the problem solving skill.	**1.1**	The students will be able to analysis the Fourier series problem.	**a,b**
2.0	To develop the skills of the students in the areas of Transforms and Partial Differential Equations.	**2.1**	Know the formation of partial differential equations.	**a,b,c**
3.0	To introduce the effective mathematical tools for the solutions of partial differential equations.	**3.1**	Apply the partial differential equations to solve the various electrical and electronics application.	**b,g**
4.0	To acquaint the student with Fourier transform techniques used in wide variety of situations.	**4.1**	Solve the problems using Fourier integral theorem and convolution theorem technique.	**a,c,g**
5.0	To develop Z transform techniques for discrete time Systems.	**5.1**	Formulate the difference equations and solve them using Z-transform techniques.	**a,b,g**

UNIT I - FOURIER SERIES	**(6+6)**
Dirichlet's conditions – Fourier series – Odd and even functions – Half range sine series – Half range cosine series - Parseval's identity – RMS value - Harmonic Analysis.	
UNIT II - PARTIAL DIFFERENTIAL EQUATIONS	**(6+6)**
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations of the type f(p,q)=0,Clairut's form – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of homogeneous types.	
UNIT III - APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	**(6+6)**
Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation (Zero and Non-zero Velocity) – One dimensional heat equation (Temperature Reduced to zero and Non-zero boundary conditions) – Steady state solution of two-dimensional heat equation (Finite and Infinite Plate).	
UNIT IV - FOURIER TRANSFORMS	**(6+6)**
Fourier integral theorem (statement only) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem– Parseval's Identity(Excluding proof).	
UNIT V - Z -TRANSFORM AND DIFFERENCE EQUATIONS	**(6+6)**
Z transforms -Elementary properties – Inverse Z transform (Partial fraction method and Residue method) – Convolution theorem (Excluding proof) –Formation of difference equations – Solution of difference equations using Z transform.	
	TOTAL (L: 30+T:30) = 60 PERIODS

TEXT BOOKS:

1. Veerarajan,T. "Engineering mathematics (for III Semester)", 3rd ed., Tata Mc Graw Hill, New Delhi, 2005
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics; Volume III", S. Chand & Co Ltd., 2008.

REFERENCES:

1. Goyal. Manish and Bali, N.P, "A Textbook of Engineering mathematics", 6th ed., Laxmi Publication (P) Ltd. New Delhi, 2012.
2. Grewal, B.S. "Higher Engineering Mathematics", 42nd ed., Khanna publishers, New Delhi, 2012.
3. Kreyszig, Erwin. "Advanced Engineering Mathematics", 9th ed., Wiley Publications, New Delhi, 2006.
4. Singaravelu.A, "Transforms and Partial Differential Equations", Reprint Edition 2013, Meenakshi Publications, Tamil Nadu.

17ITC03 - DATA STRUCTURES AND ALGORITHMS (*Common to BME,EEE,ECE and E&I Branches)*					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE - 1**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		**Course Outcomes**		**Related Program outcomes**
1.0	To enable the student to understand the Abstract Data Types.	**1.1**	The students can Understand and apply the concept of abstract data type to represent and implement heterogeneous data structures.	**a,c,j,k**
2.0	To make the students to Learn about implementation of stack and queue.	**2.1**	The Students can Exemplify and implement how Stack ADT & Queue ADTcan be implemented to manage the memory using static and dynamic allocations.	**a,c,j,k**
3.0	To enable the student to Understand the concepts of Trees.	**3.1**	The student s can Compare and contrast various techniques in Hashing and Trees.	**a,b,c,d**
4.0	To make the students to Understand the concepts of Graphs	**4.1**	The students can Understand the various types of shorting algorithms.	**a,b,c,d**
5.0	To enable the student to Understand the concepts of Sorting & Searching.	**5.1**	The students can Analyze and implement different types of sorting and searching algorithms.	**a,b,c,i**

UNIT I – INTRODUCTION	**(6)**
Data structures – Types of Data Structures - Abstract Data Type (ADT) – List ADT: Singly linked list – Doubly linked list – Circular linked list – Cursor based liked list - Applications of linked list: Addition of two polynomials – Multiplication of two polynomials.	
UNIT II – STACK AND QUEUE	**(6)**
Stack ADT – Stack model – Operations on stack – Implementation and applications. Queue ADT – Queue model – Operations on queue - Implementation and applications of Priority Queues.	
UNIT III – HASHING AND TREES	**(6)**
Introduction – Separate chaining – Open addressing - Rehashing - Extendible hashing. Binary Tree – Representation of a binary tree – Expression tree – Search tree ADT – Tree traversal – AVL tree – Single rotation – Double rotation.	
UNIT IV – GRAPHS	**(6)**
Basic terminologies – Representation of graph – Topological sort – Graph traversal - Breadth first traversal – Depth first traversal. Shortest path algorithm – Unweighted shortest path algorithm – Weighted shortest path algorithm – Minimum spanning tree – Prim's algorithm – Kruskal's algorithm.	
UNIT V – SORTING	**(6)**
Introduction – Insertion sort – Shell sort – Heap sort – Merge sort – Quick sort – Radix sort. External sorting – Two way merge – Multi way merge – polyphase merge. Searching – Linear search – Binary search.	

List of Experiments:

1. Implementing Stack ADT in Python.
2. Implementing unordered list using Linked list (ADT).
3. Implementing Queue ADT in Python.
4. Implement Binary Search Tree using Python.
5. Implementation of BFS and DFS Graph Traversal using Python.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

- LAN System with 33 nodes (OR) Standalone PCs – 33 Nos,Printers – 3 Nos.

Software:

- OS – Windows

Python 3.2/ Python IDE

TEXT BOOKS:

1. Mark Allen Weiss" Data structures and algorithm analysis in C" Pearson Education, 2015/PHI.
2. Dr. R. Nageswara Rao, ―Core Python Programming, Dreamtech Press, 2017 Edition.

REFERENCE:

1. Michael T. Goodrich, Irvine Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", 2013edition

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

17ECC05 - ELECTRICAL MACHINES AND INSTRUMENTS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to learn and understand the basics of Electrical Motor concepts.	**1.1**	The Students can Narrate Constructional details, principle of operation, performance and starters of D.C.Machines.	**a,b,f,i,k**
2.0	To enable the student to understand the basic concepts of electrical transformer	**2.1**	The Students can Explicate the Constructional details, principle of operation and testing of Transformer.	**a,c,f,j**
3.0	To make the students to understand the concepts of nduction motor. and synchronous motor.	**3.1**	The Students can Describe the Constructional details, principle of operation, starting, speed control of induction and synchronous Motors.	**a,d,i,k**
4.0	To make the students to understand basic concepts of measuring and electronics instruments .	**4.1**	The Students can Understand the principle of operation of basic measuring and electronics instruments	**a,b,f,k**
5.0	To make the students to understand various types of transducers.	**5.1**	The Students can understand about operation of various types of transducers.	**a,b,c,i,l**

UNIT I - D.C. MACHINES	**(9)**
Constructional details – emf equation – Methods of excitation – Self and separately excited generators – Characteristics of series, shunt and compound generators –Principle of operation of D.C. motor – Back emf and torque Equation – Characteristics of series shunt and compound motors - Starting of D.C. motors – Types of starters.	
UNIT II - TRANSFORMERS	**(9)**
Constructional details – Principle of operation – emf equation – Transformation ratio – Equivalent circuit - Transformer on no load – Transformer on load – Regulation - Testing – open circuit and short circuit tests.	
UNIT III - INDUCTION MOTORS & SYNCHRONOUS MACHINES	**(9)**
Construction – Types – Principle of operation of three phase induction motors – Equivalent circuit – Starting of induction motors – Construction of synchronous machines – Types.	
UNIT IV - BASIC MEASUREMENT CONCEPTS & ELECTRONIC INSTRUMENTS	**(9)**
Measurement systems –Static and dynamic characteristics –units and standards of measurements Errors-types of error-moving coil meters, moving iron meters – Bridge measurements: – Maxwell, Hay, Schering, Anderson and Wien bridge - Cathode ray oscilloscopes - Digital multimeter - spectrum analyzer.	
UNIT V – TRANSDUCERS	**(9)**
Transducers –Classification – Resistive: Strain gauge- thermocouple – thermistor, RTD – Capacitive - Piezo Electric– Inductive: LVDT.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. D.P.Kothari and I.J.Nagrath, "Basic Electrical Engineering," Tata McGraw Hill publishing company ltd, 3rd edition, 2009.
2. A.K. Sawhney, "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co, 2004.

REFERENCES:

1. S.K.Bhattacharya, “Electrical Machines”, Tata McGraw Hill publishing company Ltd,3rd Edition, 2009.
2. R.K.Rajput, “Electronic Measurements and Instrumentation”, S.Chand & company LTD, 2009.

17ECC06 - DIGITAL LOGIC DESIGN					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17ECC01	**QUESTION PATTERN : TYPE - 1**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make the students to understand the principles and theorems of Digital logic circuits.	**1.1**	The Students can apply the Boolean laws and theorems can able to minimize the Boolean expressions.	**a,b,f,i,k**
2.0	To enable the student to design memories and programmable logics.	**2.1**	The Students will be able to construct Programmable arrays and memory logics.	**a,c,f,j**
3.0	To enable the student to design and modeling of combinational circuits using Verilog.	**3.1**	The Students will be able to Design simple combinational logic circuits in hardware and simulation using Verilog.	**a,d,i,k**
4.0	To make the students to implement the synchronous sequential logic circuits.	**4.1**	The Students will be able to Design synchronous sequential logic circuits in hardware and simulation using Verilog.	**a,b,f,k**
5.0	To make the students to design the asynchronous sequential logic circuits.	**5.1**	The Students will be able to Design asynchronous sequential logic circuits.	**a,b,c,i,l**

UNIT I - BOOLEAN ALGEBRA AND GATE-LEVEL MINIMIZATION	**(9)**
Brief review of Digital systems, Binary numbers, Number base conversions, Complements, Binary arithmetic, Axiomatic Definition of Boolean Algebra, Basic Theorems of Boolean Algebra, Boolean Functions-Digital Logic Gates. SOP and POS- Simplification of Boolean Expressions using K-map Method and Quine- McClusky Method. Don't Care Conditions. NAND and NOR Implementations.	
UNIT II - MEMORY AND PROGRAMMABLE LOGIC FAMILIES	**(9)**
Introduction to Memory Devices-ROM, PROM, EPROM, EEPROM- Random Access Memory-Static RAM and Dynamic RAM- Programmable Logic families - Programmable Logic Array PLA, Programmable Array Logic PAL. Introduction to FPGA.	
UNIT III - DESIGN AND MODELING OF COMBINATIONAL LOGIC CIRCUITS	**(9)**
Analysis Procedure, Design Procedure, Binary Adder and Subtractor, Binary Multiplier, Code Converters, Magnitude Comparator, Decoders, Encoders, Multiplexers, De-multiplexers, Parity generator and Checker. Hardware Description Language (HDL) - Modeling of above Combinational circuits using Verilog.	
UNIT IV – SYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS	**(9)**
Introduction-Storage Elements: Latches, Flip-Flops-SR, D, JK & T, Realization of FFs. Mealy and Moore Models-Design of counters-Ripple counters, Modulo-n counters, Johnson & Ring Counters. Shift Registers-SISO, SIPO, PISO, PIPO.	
UNIT V – ASYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS	**(9)**
Introduction- Analysis and Design Procedure - State table and State diagrams, State Reduction Techniques. Design of asynchronous sequential circuits. Races and Cycles- Hazards, Design of Hazard free Circuits. Modeling of Sequential Circuits using Verilog.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. M. Morris Mano & Michael D.Ciletti, "Digital Design with an Introduction to the Verilog HDL, 5th Edition, Prentice Hall of India Pvt.Ltd. 2015.
2. Dr. Sanjay Sharma, "Digital Electronics and Logic Design" 4th Edition., S.K.Kataria & Sons, 2017.

REFERENCES :

1. Stephan D.Brown & Zvonko G.Vranesic, "Fundamentals of Digital Logic with VHDL Design, 2'nd Edition., Tata Mc Graw – Hill, 2003.
2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis,"2'nd Edition., Prentice Hall, 2009.
3. Thomas L. Floyd & R P Jain, "Digital Fundamentals," 10th Edition., PHI, 2011.
4. Ronald J Tocci & Neal S. Widmer, "Digital Systems, Principles and Applications," 10th Edition., Pearson education, 2011.
5. Frank Vahid, "Digital Design with RTL Design, Verilog and VHDL," 10'th Edition, John Wiley and Sons, 2010.

17ECC07 - SIGNALS AND SYSYTEMS					
		L	T	P	C
		2	2	0	3
PREREQUISITE : 17MYB02	**QUESTION PATTERN : TYPE - 3**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To understand the basic properties of signal & systems and its various methods of classification	**1.1**	The students will be able to Understand the operation of continuous time & Discrete time signals	**a,b,d,l**
2.0	To learn Laplace Transform &Fourier transform and their properties	**2.1**	The students will be able to Analyze the properties of signals & systems	**a,d,e**
3.0	To know Z transform and their properties	**3.1**	The students will be able to Apply Laplace transform, Fourier transform, Z transform in signal analysis	**a,f,k**
4.0	To motivate the students to implement the discrete time system using impulse response and inputs.	**4.1**	The students will be able to Implementation of continuous time LTI systems using Fourier and Laplace Transforms.	**b,f,j,k**
5.0	To characterize LTI systems in the Time domain and various Transform domains	**5.1**	The students will be able to Designing of discrete time LTI systems using Z transform	**b,f,j,l**

UNIT I - CLASSIFICATION OF SIGNALS AND SYSTEMS	**(6+6)**
Standard Signals: Unit impulse, unit step, unit ramp, exponential, and sinusoidal signals, Classification of Continuous and discrete time signals, Types of signals: power, energy, periodic, even and odd, Basic Operations on Signals, Basic System Properties: Linearity, Time Invariant, causality, stability and invertibility, LTI.	
UNIT II - TIME DOMAIN CHARACTERISATION OF CONTINUOUS TIME LTI SYSTEM	**(6+6)**
Convolution Integral, Properties of continuous time LTI system-Causality, stability, Causal continuous time LTI system described by differential equations.	
UNIT III- FREQUENCY DOMAIN REPRESENTATION IN CT SIGNALS	**(6+6)**
Fourier series representation of continuous time periodic signals, properties of continuous time Fourier series, Fourier transform of continuous time aperiodic signals and periodic signals, properties of continuous time Fourier transform, Laplace transform, Region of Covergence, Inverse Laplace transform.	
UNIT IV – TIME DOMAIN CHARACTERISATION OF DISCRETE TIME LTI SYSTEM	**(6+6)**
Sampling theorem (Low Pass) – Reconstruction of a Signal from its samples, aliasing, Convolution sum, properties of discrete time LTI system, Causal discrete time LTI system described by difference equations.	
UNIT V- FREQUENCY DOMAIN REPRESENTATION IN DT SIGNALS	**(6+6)**
Z Transform, Inverse Z transform – Long division – partial fraction, ROC, Properties of Z Transform: Linearity, time shifting, change of scale, Z-domain differentiation, differencing, accumulation, convolution in discrete time, initial and final value theorems.	

TOTAL (L: 30+T:30) = 60 PERIODS

TEXT BOOK:

1. Alan V.Oppenheim, Alan S.Wilsky and S.Hamid Nawab, "Signals and Systems,"2nd Edition. Prentice-Hall of India.2012.

REFERENCES:

1. B. P. Lathi, “Principles of Linear Systems and Signals”, Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, “Signals & Systems - Continuous and Discrete”, Pearson, 2007.
3. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 2007.
4. Signals and Systems with MATLAB Applications, Second Edition, Steven T. Karris**,** Orchard Publications,2006

17ECC08 - ANALOG ELECTRONICS			
L	T	P	C
3	0	0	3

PREREQUISITE : 17ECC01	QUESTION PATTERN : TYPE - 1

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To understand the different biasing techniques of amplifier.	1.1	The Students able to understand and design amplifier biase circuit.	a,b,d,g
2.0	To study about small signal analysis of amplifiers.	2.1	The Students will be able to analysis the amplifier using h model.	a,b,d
3.0	To study about high frequency response of amplifiers and different types of power amplifier.	3.1	The Students will be able to analyse the frequency response of amplifier and aware of power amplifier characteristics.	a,b,d,j
4.0	To get aware of analysis knowledge of feedback amplifier and tuned amplifier.	4.1	The students will be able to have idea about feedback amplifier and able to analyse the working of tuned amplifier .	a,b,c,d,j
5.0	To obtain knowledge about oscillators design and multivibrators	5.1	The students will be able to design oscillator and multivibrators	a,b,c,d,f,g,j

UNIT I - TRANSISTOR BIAS STABILITY	**(9)**
BJT – Need for biasing – Stability factor - Load line and quiescent point. - Different types of biasing circuits - Method of stabilizing the Q point - Bias compensation – Diode, Thermister and Sensistor compensations – Biasing of FET.	
UNIT II - SMALL SIGNAL AMPLIFIERS	**(9)**
Introduction –Analysis of transistor amplifier circuit using h parameters- Simplified CB, CE&CC - Darlington connection for high input impedance.	
UNIT III - FREQUENCY RESPONSE OF AMPLIFIERS AND POWER AMPLIFIERS	**(9)**
Frequency response of amplifiers: cutoff frequencies and bandwidth –Multistage amplifiers: coupling methods-CE-CC amplifier- frequency response of multi stage amplifiers. Classification of amplifiers; Class A, Transformer coupled Class A audio amplifier - Class B amplifier - push-pull amplifier - Class C amplifier.	
UNIT IV - FEEDBACK AMPLIFIERS AND TUNED AMPLIFIERS	**(9)**
Basics of distortions occur in amplifiers. Feedback amplifiers: Effect of negative feedback onamplifiers. Nyquist criterion. Tuned Amplifier: single and double tuned amplifiers- Stagger tuned amplifiers. Stability of tuned amplifiers - Neutralization - Hazeltine neutralization method.	
UNIT V- OSCILLATORS AND MULTIVIBRATORS	**(9)**
Barkhausen Criterion - Analysis of LC oscillators : Hartley - Colpitts - Clapp oscillator , RC oscillators : RC Phase shift oscillator - Wien bridge oscillator - Crystal Oscillators - Multivibrators - Astable multivibrator - Monostable multivibrator - Bistable multivibrator - Schmitt trigger	
TOTAL (L: 45 T:15) = 60 PERIODS	

TEXT BOOK:

1. S. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits, McGraw Hill Private limited, Fifth Reprint 2014.

REFERENCES :

1. Millman J and Halkias .C, Integrated Electronics, 2nd Edition, TMH, 2009.
2. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 9th Edition, Pearson Education / PHI, 2007.
3. David A. Bell, Electronic Devices & Circuits, Oxford Higher Education Press, 5th Edition, 2010.
4. Muhammad H. Rashid , Microelectronic Circuits: Analysis and Design, 2nd Edition, Cengage Learning, 2011.
5. Donald .A. Neamen, Electronic Circuit Analysis and Design –2nd edition, TMH, 2009.
6. Rashid M, Microelectronics Circuits, Thomson Learning, 2007.

17ECP03 - DIGITAL LOGIC DESIGN LABORATORY				
	L	T	P	C
	0	0	4	2
PREREQUISITE : 17ECP01	**QUESTION PATTERN : TYPE -NIL**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to learn and practice the basics of logic gates	**1.1**	The Students can be able to analyze the characteristics of diodes and transistors.	**a,b,e,k**
2.0	To enable the student to design the combinational logic circuits.	**2.1**	The Students will be able to design the combinational circuits like adder, subtractor, code convertors, encoder & decoders.	**a,b,f,k**
3.0	To make the students to learn and practice with design of sequential logic circuits.	**3.1**	The Students will be able to design the sequential circuits like counters and shift registers.	**a,j,l**
4.0	To enable the students to learn about Verilog code for combinational and sequential circuits.	**4.1**	The students will be able to Implement combinational and sequential circuits using Verilog codes.	**b,d**
5.0	To motivate the students to implement the project using basic digital logics.	**5.1**	The Students will be able to design own projects based on digital logic.	**c,g**

LIST OF EXPERIMENTS:

Hardware Experiments:

1. Verification of Boolean expressions.
2. Construct a Half Adder, Full Adder using Multiplexer.
3. Construct a Code Converter circuit.(Binary to gray and BCD to XS-3)
4. Implementation of Magnitude Comparator circuit using logic gates.
5. Construct a Priority Encoder using logic gates.
6. Design adder circuit using decoders.
7. Construct a Multiplexer and De-Multiplexer circuit using logic gates.
8. Verification of SR, JK, D and T Flip Flops.
9. Design of Synchronous Counter using flip-flops.
10. Design of Shift Registers using flip-flops.

Software Experiments(Using Model Sim) :

11. Modeling and Simulation of Half adder, Full adder using Verilog.
12. Modeling and Simulation of Synchronous Counters using Verilog.

TOTAL (P: 60) = 60 PERIODS

17ECP04 - ANALOG ELECTRONICS LABORATORY			
L	T	P	C
0	0	4	2

PREREQUISITE : 17ECP01	QUESTION PATTERN : TYPE -NIL

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To design and construct different amplifiers biasing circuits.	**1.1**	The Students can be able to design and analyze the amplifier biasing circuits.	**a,b,d,k**
2.0	To gain design knowledge of negative feedback amplifiers.	**2.1**	The Students can be able to design and analyze the frequency response negative feedback amplifier.	**a,c,e,f,k**
3.0	To learn about designing of various types of oscillators.	**3.1**	The Students will be able to design different oscillator circuits and observe their output waveform	**a,c,e,k**
4.0	To construct and analysis the different power amplifier	**4.1**	The students will be able to experiment power amplifiers.	**a,e,k,l**
5.0	To understand working multivibrators and wave shapers.	**5.1**	The students will be able to experiment the multivibrator and wave shapers	**a,e,k,l**

LIST OF EXPERIMENTS:

1. Design and Construct BJT CE amplifier using Biasing Technique.
2. Construct Darlington Amplifier using BJT and measure its bandwidth.
3. Design and implementation of Class B Power Amplifier.
4. Design and implementation of Negative feedback amplifier.
5. Implementation of Single tuned amplifier.
6. Design and Implementation of RC phase shift oscillator.
7. Design and Implementation of Hartely oscillator.
8. Implementation of Astable and Monostable multivibrators.
9. Simulation of Class A amplifiers.
10. Simulation of Astable Multivibrator.
11. Simulation of Schmitt Trigger .

TOTAL (P: 60) = 60 PERIODS

17GED02 – SOFT SKILLS – READING AND WRITING				
	L	T	P	C
	0	0	2	0
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE - NIL**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To recollect the functional understanding of parts of speech and basic grammar.	**1.1**	The Students can be able to Apply the knowledge to identify the parts of speech and construct the sentences.	**a,b,d,l**
2.0	To acquire the reading skills through cloze texts, matching and multiple choice modes.	**2.1**	The Students can be able to Develop the reading skills through cloze texts, matching and multiple choice modes.	**a,d,e**
3.0	To enhance the writing skills for a variety of purposes.	**3.1**	The Students can be able to Interpret effectively through writing for a variety of purposes.	**a,f,k**

UNIT I - GRAMMAR	**(10)**
Articles - Adjectives - Conjunctions - Prepositions - Idioms & Phrases.	
UNIT II - READING	**(10)**
Part I : Matching 7 sentences to four short texts Part II: Text with sentences missing Part III: Text with multiple choice questions Part IV: Text with multiple choice gaps Part V: Identification of additional unnecessary words in text	
UNIT III- WRITING	**(10)**
Part I : E-mail writing, Writing short notes, Memo, Agenda & Minutes Part II: Report Writing, Complaint Letter, Writing Proposals	
TOTAL (L: 30) = 30 PERIODS	

REFERENCES:

1. Murphy, Raymond, "Essential Grammar in Use", Cambridge University Press, UK, 2007.
2. Whitby, Norman, "Business Benchmark Pre - Intermediate to Intermediate Preliminary", 2nd ed., Cambridge University Press, 2013

17MYB09 - PROBABILITY AND RANDOM PROCESSES *(For ECE and BME Branches)*				
L	**T**	**P**	**C**
2	**2**	**0**	**3**
PREREQUISITE : 17MYB02	**QUESTION PATTERN : TYPE -4**		

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	Enable students to understand the concepts of probability, conditional probability and independence.	**1.1**	The students will be able to understand the fundamental knowledge of the basic probability concepts.	**a,b**
2.0	Be able to obtain the distributions of functions of random variables.	**2.1**	Have a well-founded knowledge of standard distributions which can describe real life phenomena.	**a,b,c**
3.0	Understand the classifications of random processes.	**3.1**	Acquire skills in handling situations involving more than one random variable and functions of random variables.	**b,g**
4.0	Understand the concepts of as strict stationary, wide-sense stationary and Ergodic.	**4.1**	Understand and characterize phenomena which evolve with respect to time in probabilistic manner.	**a,c,g**
5.0	Understand the concepts of correlation functions and power spectral density.	**5.1**	Apply concept and properties of spectral density function and cross correlation functions.	**a,b,g**

UNIT I - PROBABILITY AND RANDOM VARIABLES	**(6+6)**
Random variable-Probability mass function – Probability density functions – Properties - Moments –Moment generating functions and their properties.	
UNIT II - STANDARD DISTRIBUTIONS	**(6+6)**
Discrete distributions: Binomial, Poisson-Continuous distributions: Uniform, Normal distributions and their properties.	
UNIT III - TWO DIMENSIONAL RANDOM VARIABLES	**(6+6)**
Joint distributions-Marginal and conditional distributions-Covariance-Correlation and Regression-Transformation of random variables-Central limit theorem (Excluding proof).	
UNIT IV - RANDOM PROCESSES	**(6+6)**
Definition and examples-first order, second order, strictly stationary, wide-sense stationary and Ergodic process-Markov process-Binomial, Poisson processes.	
UNIT V - CORRELATION AND SPECTRAL DENSITIES	**(6+6)**
Auto correlation-Cross correlation-properties-Power spectral density-Cross spectral density-properties-Wiener-Khintchine relation (Statement Only)-Relationship between cross power spectrum and cross correlation function.	
TOTAL (L: 30+T:30) = 60 PERIODS	

TEXT BOOKS:

1. Veerarajan. T, "Probability, Statistics and Random Processes," 3rd ed., New Delhi, Tata McGraw-Hill, 2008.
2. Venkatarama Krishnan, "Probability and random Process",2nd Edition, John Wiley &Sons, New Jersey,2016.

REFERENCES:

1. Scott L. Miller and Donald Childers, "Probability and Random Processes with applications to Signal Processing and communications," Elsevier, 2012.
2. Gubner A.John, "Probability and Random Processes for Electrical and Computer Engineers", Cambridge University press, Newyork, 2006.
3. Charles W.Therrien, Murali Tummala, "Probability and random process for electrical and computer Engineers", CRC Press, Newyork, 2012.
4. Singaravelu.A, Sivasubramanian, Ramaa, "Probability, Statistics and Random Processes," 2nd ed., Meenakshi Publication, Chennai, 2003.

17ITC08 - FUNDAMENTALS OF JAVA PROGRAMMING
(Common To ECE,EEE,BME and E&I Branches)

L	T	P	C
2	0	2	3

PRE REQUISITE : NIL | **QUESTION PATTERN: TYPE –I**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To learn the fundamental concepts of Java.	**1.1**	The students will be able to learn fundamental concepts of Java.	**a,b,e**
2.0	To apply inheritance concepts using class.	**2.1**	The students will be able to design concepts with inheritance.	**a,b**
3.0	To implement exception handling and Files.	**3.1**	The students will be able to implement exception handling and Files.	**a,b,e**
4.0	To create threads and interfaces in Java classes.	**4.1**	The students will be able to create threads and interfaces in Java classes.	**a,b**
5.0	To learn GUI and generics concepts	**5.1**	The students will be able to implementGUI and generics concepts.	**a,b,e**

UNIT I INTRODUCTION **(6+6)**

Introduction of Java - Features Of Java – Application of Java – Data Types –Statements – Operators – Control statements - Basics of Oops Concepts: Class – Objects – Methods –Constructor – finalizer –Access Control.

UNIT II INHERITANCE AND KEYWORDS **(6+6)**

Inheritance: Types Of Inheritance – Polymorphism – Method Overloading – Method Overriding- super – final with inheritance – Abstract Class - Keywords : static –final - this - String – String Buffer - Arrays

UNIT III PACKAGE, EXCEPTION HANDLING AND FILES **(6+6)**

Packages – Package Hierarchy –Basics of Exception Handling – Input / Output Basics – Streams – Byte streams and Character streams – Reading and WritingConsole – Reading and Writing Files

UNIT IV INTERFACES AND THREADS **(6+6)**

Interfaces – Interface Design – Threads – Thread Synchronization - Multi-Thread Programming.

UNIT V GENERICS AND GUI **(6+6)**

Generic Programming – Generic classes – generic methods - Introduction to Swing – layout management - Swing Components – TextFields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.Applet programming - Basics of event handling - event handlers - adapter classes - actions - mouse events.

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

List of Experiments:

1. Program to implement Operators, Flow Controls
2. Program to implement Classes, Constructors, Overloading
3. Program using Static and Final
4. Program using File Streams and IO Streams
5. Program to implement Strings, String Buffer
6. Program using Interfaces, Abstract Classes
7. Program to implement Exception Concepts and Threads
8. Program to implement Swing Application.

TEXT BOOK:

1. Herbert Schildt, “The Complete Reference (Fully updated for jdk7)”, Oracle press Ninth Edition,2014.

REFERENCE:

1. Deitel&Deitel, “Java How to Program”, Prentice Hall, 10th Edition, 2016.

17ECC10 - ELECTROMAGNETIC FIELDS					
		L	T	P	C
		2	2	0	3
PREREQUISITE : 17PYB01	**QUESTION PATTERN : TYPE - 1**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to learn and understand the basics of Vector Calculus and Gauss law.	**1.1**	The Students can apply vector calculus to static electric and magnetic fields in different engineering situations.	**a,b,g,h,j,l**
2.0	To enable the student to evaluate the electric field due to line charge and boundary conditions.	**2.1**	The Students will be able to analyze fields a potentials due to static changes	**a,b,f,g,h,j,l**
3.0	To enable the student to evaluate the magnetic field due to line charge and boundary conditions.	**3.1**	The Students will be able to evaluate static magnetic fields	**a,b,f,g,h,j,l**
4.0	To make the students to analyze about time varying electric and magnetic fields.	**4.1**	The students can understand the relation between the fields under time varying situations	**a,b,c,d,e,g,l**
5.0	To make the students to know about the electromagnetic wave equation and wave polarization.	**5.1**	The students can acquire knowledge about electromagnetic waves and its polarization	**a,b,c,d,e,g,h,k,l**

UNIT I - VECTOR ANALYSIS	**(6+6)**
Scalar and Vector analysis - Vector algebra - Coordinate systems: Cartesian coordinate system, cylindrical coordinate system and spherical coordinate system - Divergence, gradient and curl – Divergence and Stokes theorems- Coulomb's Law - Gauss Law & its applications.	
UNIT II - ELECTROSTATICS	**(6+6)**
Electric field intensity – Continuous Charge Distribution, Electric Field due to Charge Distribution, Electric Field due to charges distributed uniformly on an infinite, finite line and circular disc. Relationship between potential and electric field - Electric flux density. Current and Current Density – Boundary conditions for electric fields between free space and conductors, and between dielectrics – Poisson's & Laplace's equations.	
UNIT III - MAGNETOSTATICS	**(6+6)**
Biot-Savart's law, Magnetic field intensity due to finite and infinite line - Ampere's circuital law and its applications– Magnetic flux density – Force on a moving charge (Lorentz force), Force on a differential current element. Torque on a loop carrying a current I- Magnetic Boundary conditions.	
UNIT IV - TIME VARYING ELECTRIC AND MAGNETIC FIELDS	**(6+6)**
Faraday's law, Conduction and Displacement current density. Maxwell's Equation in integral form and Point form. Maxwell's four equations in Phasor form. Poynting Vector and the flow of power – Power flow in a co-axial cable – Instantaneous Average and Complex Poynting Vector.	
UNIT V - ELECTROMAGNETIC WAVES	**(6+6)**
Derivation of Wave Equation in free space and conducting medium- Wave equation in Phasor form-Reflection of Plane Waves by a perfect dielectric at normal incidence. Wave polarization: Linear, Elliptical and Circular polarizations.	
TOTAL (L: 30+T:30) = 60 PERIODS	

TEXT BOOK:

1. William H Hayt, John A Buck and M Jaleel Akhtar "Engineering Electromagnetics," 8th Edition, Tata McGraw Hill, New Delhi, 2014..

REFERENCES :

1. Matthew N.O.Sadiku: "Elements of Engineering Electromagnetics" Oxford University Press, 4th Edition, 2007.
2. E.C. Jordan & K.G. Balmain "Electromagnetic Waves and Radiating Systems." Pearson Education/PHI 4th Edition 2006.

17ECC11- ANALOG CIRCUIT DESIGN				
	L	T	P	C
	3	0	0	3
PREREQUISITE : 17ECC01	**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make the students to understand the circuit configurations for Linear Integrated Circuits.	**1.1**	The Students can able to understand basic concepts of Linear IC's.	**a,b,f,i,k**
2.0	To enable the student to design the basic applications of an op-amp.	**2.1**	The Students will be able to design all Linear and Non linear op-amp configurations.	**a,c,f,j**
3.0	To enable the student to design analog multiplier, PLLs and their applications.	**3.1**	The Students will be able to Design simple analog multiplier circuits and PLL applications.	**a,d,i,k**
4.0	To make the students to design A to D and D to A converters.	**4.1**	The Students will be able to Design A to D and D to A converters.	**a,b,f,k**
5.0	To make the students to design the simple circuits using timers.	**5.1**	The Students will be able to Design simple analog circuits using op-amp.	**a,b,c,i,l**

UNIT I - CIRCUIT CONFIGURATION FOR LINEAR ICS	**(9)**
Introduction-Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Ideal operational amplifier, General operational amplifier stages ,IC 741 Op-Amp, slew rate, CMRR, Open and closed loop configurations.	
UNIT II - APPLICATIONS OF OPERATIONAL AMPLIFIERS	**(9)**
Sign Changer, Scale Changer, Voltage Follower, V-to-I and I-to-V converters, Summing amplifier, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Precision Rectifier, Schmitt trigger, Low-pass, high-pass and band-pass filters.	
UNIT III - ANALOG MULTIPLIER AND PLL	**(9)**
Analog Multiplier- Applications- Squarer and frequency doubler, Gilbert Multiplier cell – Variable trans conductance technique, Operation of the basic PLL,Capture range, Lock in range and Pull in time , Application of PLL for AM detection, FM detection, FSK modulation and demodulation.	
UNIT IV - DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS	**(9)**
Introduction- D/A converter – specifications -Binary weighted resistor type, R-2R Ladder type, High speed sample-and-hold circuits, A/D Converters –specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type.	
UNIT V - WAVEFORM GENERATORS AND SPECIAL FUNCTION IC's	**(9)**
Sine-wave generators, and Triangular wave generator, Saw-tooth wave generator, CL8038 function generator, Timer IC 555- Astable and Monostable operation, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator -Monolithic switching regulator, Frequency to Voltage and Voltage to Frequency converters, Video Amplifier, Opto-couplers and fibre optic IC.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Robert F. Coughlin and Driscoll, “Operational Amplifiers and Linear Integrated Circuits,”6th ed., Pearson Education. 2009.
2. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits” , 3’rd Edition,TMH,2007.

REFERENCES :

1. S. Salivahanan and V.S. Kanchana Bhaaskaran, “Linear Integrated Circuits”, Tata McGraw Hill (2008).
2. P. R. Gray and R. G. Meyer, “Analysis and Design of Analog Integrated Circuit,” John Wiley, 2009

17ECC12 - DIGITAL SIGNAL PROCESSING *(Common to ECE,E&I and IT Branches)*				
	L	**T**	**P**	**C**
	2	**2**	**0**	**3**
PREREQUISITE : Nil	**QUESTION PATTERN : TYPE - 3**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To learn discrete Fourier transforms and Fast Fourier Transform and its properties.	**1.1**	The Students can apply DFT and FFT for the analysis of digital signals & systems.	**a,b,d,f,g,j**
2.0	To know the characteristics of FIR filters learn the design of finite impulse response filters for filtering undesired signals.	**2.1**	The students will be able to design and implement digital FIR filters.	**a,b,c,d,f,g,j**
3.0	To know the characteristics of IIR filters learn the design of infinite impulse response filters for filtering undesired signals.	**3.1**	The students will be able to design and implement digital IIR filters.	**a,b,c,d,f,g,j**
4.0	To understand Finite word length effects.	**4.1**	The students will be able to characterize finite Word length effect on filters.	**a,c,d,g**
5.0	To study the concept of Digital Signal Processor.	**5.1**	The Students can apply real time applications.	**c,g**

UNIT I - FAST FOURIER TRANSFORMS	**(6+6)**
Introduction to DFT and IDFT. Properties of DFT. FFT Algorithm-Radix-2 - Decimation in Time (DIT)-Decimation in Frequency (DIF).Fast Convolution-Overlap Save method-Overlap Add Method.	
UNIT II - DIGITAL FIR FILTERS	**(6+6)**
Design characteristics of FIR filters with linear phase – Frequency response of linear phase FIR filters - Design of FIR filters using window functions (Rectangular, Hamming, Hanning, and Blackman) - Realization FIR filter-Direct Form I only.	
UNIT III - DIGITAL IIR FILTERS	**(6+6)**
Review of design techniques for analog low pass filter (Butterworth and Chebyshev approximations), Frequency transformation in Analogue domain, IIR filter Design: Bilinear and Impulse Invariant Techniques. Realization IIR filters-Direct Form I, Direct Form II.	
UNIT IV - FINITE WORD LENGTH EFFECT	**(6+6)**
Review of Number Representation, Types of Number Representation, Binary Fixed Point and Floating Point – Comparison, Quantization Noise - Truncation and Rounding, Input Quantization Error, Product Quantization Error, Coefficient Quantization error - Steady state Input and Output Noise Power, Zero input Limit Cycle Oscillation-Dead band.	
UNIT V -DIGITAL SIGNAL PROCESSOR	**(6+6)**
Architectural Features-Harvard Architecture, Von Neumann Architecture, VLIW Architecture, DSP Building Blocks-Multiplier, Shifter, MAC Unit, ALU. Pipelining.	
TOTAL (L: 30+T:30) = 60 PERIODS	

TEXT BOOK:

1. J.G.Proakis, D.G.Manolakis and D.Sharma, “Digital Signal Processing, Algorithms and Applications”, Pearson Education, 2012.

REFERENCES:

1. S. Salivahanan, A. Vallavaraj and G.Gnanapriya, "Digital Signal Processing", Tata McGraw-Hill Company Publication Limited, 21 st Reprint 2007.
2. Oppenheim V.A.V and Schaffer R.W, "Discrete – time Signal Processing", 2nd Edition, Prentice Hall, 2013.
3. S.K.Mitra, Digital Signal Processing, 4rh Edition, TMH, 2010.
4. Lawrence R Rabiner and Bernard Gold, "Theory and Application of Digital Signal Processing", PHI 2010.

17ECP06 - ANALOG CIRCUIT DESIGN LABORATORY			
L	T	P	C
0	0	4	2

PREREQUISITE : 17ECP01	QUESTION PATTERN : TYPE -NIL

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to learn and practice the basic modes of operational amplifiers.	**1.1**	The Students can be able to analyze the characteristics of Inverting and Non inverting amplifiers.	**a,b,e,k**
2.0	To enable the student to design the Integrator and Differentiator circuits.	**2.1**	The Students will be able to design the Oscillator circuits and Integrator and Differentiators.	**a,b,f,k**
3.0	To make the students to learn and practice with astable and monostable multivibrators.	**3.1**	The Students will be able to design the astable and monostable multivibrator circuits using 555 timers.	**a,j,l**
4.0	To enable the students to learn about active filters.	**4.1**	The students will be able to Implement filter circuits using op-amp.	**b,d**
5.0	To motivate the students to implement the project using operational amplifiers.	**5.1**	The Students will be able to design own projects using analog IC. .	**c,g**

LIST OF EXPERIMENTS:

1. Design of Inverting and Non Inverting amplifier for a specified gain using OP-Amp IC741.
2. Design of differentiator and integrator for a specified gain using OP-Amp IC741.
3. Design of a sinusoidal oscillator for specified frequency based on Wien Bridge oscillators using IC-741.
4. Design of a sinusoidal oscillator for specified frequency based on RC phase shift oscillators using IC-741.
5. Design of Astable Multivibrators using NE555 Timer.
6. Design of Monostable Multivibrators using NE555 Timer.
7. Design and testing of Active Filter LPF for specified frequency.
8. Design and testing of Active Filter HPF for specified frequency.
9. Study of Voltage Regulator using IC723.

TOTAL (P: 60) = 60 PERIODS

17ECP07 - DIGITAL SIGNAL PROCESSING LABORATORY					
		L	T	P	C
		0	0	4	2
PREREQUISITE : 17ECC07		QUESTION PATTERN : TYPE -NIL			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	The student should be made to generate various signals.	**1.1**	The Students will be able to Carry out simulation of DSP signals.	**a,b,f,i,l**
2.0	The student should be made to computation of circular and linear convolution.	**2.1**	The Students will be able to Demonstrate the applications of FFT to DSP.	**a,b,f,l**
3.0	The student should be made to implement FIR and IIR filters.	**3.1**	The Students will be able to Implement FIR and IIR filters for various applications of DSP.	**a,b,f**
4.0	The student should be made to demonstrate Finite word length effect.	**4.1**	The students will be able to Analyze Finite word length effect on DSP systems.	**a,d,k,l**
5.0	The student should be made to study the architecture of DSP processor.	**5.1**	The Students will be able to Demonstrate their abilities towards DSP processor based implementation of DSP systems.	**c,i,k**

LIST OF EXPERIMENTS:

SIMULATION BASED EXPERIMENTS:

1. Generation of Signals Using Mat lab Function.
2. Implementation of DIT and DIF Algorithms.
3. Implementation of Linear convolution and Circular convolution.
4. Implementation of FIR Filter Design.
5. Implementation of IIR Filter Design.
6. Study of Power Spectrum Estimation.

PROCESSOR BASED EXPERIMENTS:

1. Simulation of Waveform Generator.
2. Simulation of Convolution - Using C Coding.
3. Design of FIR filter.
4. Design of IIR filter.

TOTAL (P: 60) = 60 PERIODS

17GED01 - SOFT SKILLS-LISTENING AND SPEAKING				
	L	T	P	C
	0	0	2	0
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE - NIL**			

COURSE OBJECTIVES AND OUTCOMES:

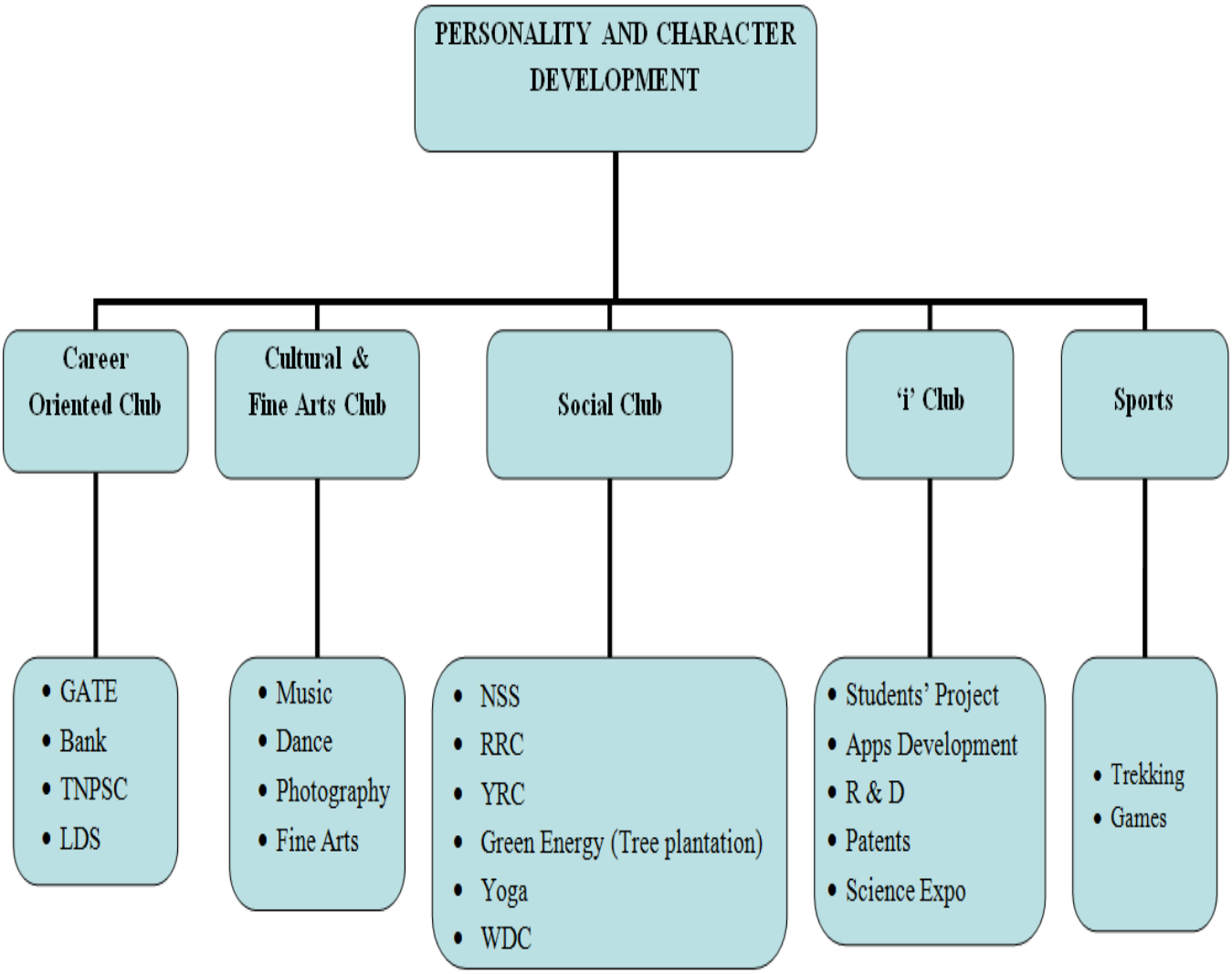
	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To recollect the functional understanding of basic grammar and its structure.	**1.1**	Apply the knowledge of basic grammar to classify the types of verbs and questions and to construct the sentences.	**i,k,l**
2.0	To acquire the listening skills through note completion, matching and multiple choice modes.	**2.1**	Develop the listening skills through note completion, matching and multiple choice modes.	**i,k,l**
3.0	To develop speaking skills through self introduction, short talk and topic discussion.	**3.1**	Organize a presentation on the given topic.	**i,k,l**

UNIT I - GRAMMAR	**(10)**
Tenses - Verb (Auxiliary and Modal) - 'Yes/No' Type Questions - Reported Speech - Gerund - Phrasal Verbs	
UNIT II - LISTENING	**(10)**
Part I : Note completion Part II: Matching Part III: Multiple Choice	
UNIT III- SPEAKING	**(10)**
Part I : Self Introduction Part II: Short talk on business topics Part III: Discussion in pairs	
TOTAL (L: 30) = 30 PERIODS	

REFERENCES:

1. Murphy, Raymond, "Essential Grammar in Use", Cambridge University Press, UK, 2007
2. Whitby, Norman ,"Business Benchmark Pre- Intermediate to Intermediate Preliminary, 2nd ed., Cambridge University Press, 2013.

17GED03 - PERSONALITY AND CHARACTER DEVELOPMENT				
	L	T	P	C
	0	0	1	0



***LDS - Leadership Development Skills**

OBJECTIVES :				
Career Oriented Club	**Cultural & Fine Arts Club**	**Social Club**	**'i' club**	**Sports**
• To provide support for identifying specific career field of interests and career path • To provide support for preparing for competitive exams	• To bring out the hidden talent of students in music, dance and other fine arts. • To promote photography skill among the students • To develop and enhance the performance of students by participating in various events • To inculcate managerial capabilities such as event management and stage organization	• To create social awareness and develop a sense of social and civic responsibility • To inculcate socially and environmentally sound practices and be aware of the benefits • To encourage the students to work along with the people in rural areas, thereby developing their character, social consciousness, commitment, discipline and being helpful towards the community.	• To inculcate the basic concepts of innovation • To foster the networking between students, build teams, exchange ideas, do projects and discuss entrepreneurial opportunities • To enrich the academic experience, build competencies and relationships beyond the classroom	• To provide opportunities to excel at sports • To promote an understanding of physical and mental well-being through an appreciation of stress, rest and relaxation. • To develop an ability to observe, analyze and judge the performance of self and peers in sporting activities. • To develop leadership skills and nurture the team building qualities. **Trekking:** • To provide opportunities to explore nature and educating about the purity of nature • To improve physical and mental health.

OUTCOMES : At the end of this course, the students will be able to				
• Find a better career of their interest. • Make use of their knowledge during competitive exams and interviews.	• Take part in various events • Develop team spirit, leadership and managerial qualities	• Develop socially responsive qualities by applying acquired knowledge • Build character, social consciousness, commitment and discipline	• Apply the acquired knowledge in creating better solutions that meet new requirements and market needs • Develop skills on transforming new knowledge or new technology into viable products and services on commercial markets as a team	• Demonstrate positive leadership skills that contribute to the organizational effectiveness • Take part an active role in their personal wellness (emotional, physical, and spiritual) that supports a healthy lifestyle • Create inclination towards outdoor activity like nature study and Adventure.

TOTAL [2 x (P: 15)]: 30 PERIODS

(Cumulatively for Two Semesters)

17GEA02 – PRINCIPLES OF MANAGEMENT				
L	T	P	C
3	0	0	3

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE - 3**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To study the importance and functions of management in an organization.	**1.1**	The Students will acquire comprehensive knowledge on management concepts.	**g, h, i**
2.0	To study the importance of planning and also the different types of plan.	**2.1**	The Students will be able to understand and apply planning concepts at different conditions and situations.	**c, d, g, i**
3.0	To understand the different types of organization structure in management	**3.1**	The Students will accomplish organizational structures and understand the staffing process.	**c. d, f, i**
4.0	To understand the basis and importance of directing in management	**4.1**	The Students will be able to employee's motivation and project managements in working environments.	**d, f, j, k**
5.0	To understand the importance of control techniques	**5.1**	The Students will be able to do the budgetary and non-budgetary control of projects.	**c, e, g, k**

UNIT I - OVERVIEW OF MANAGEMENT	**(9)**
Definition of management – Science & Art – Management & Administration - Role of managers – Evolution of Management thoughts – Contribution of Taylor and Fayol – Functions of management – Strategies for International business.	
UNIT II - PLANNING	**(9)**
Nature and purpose of planning - Planning process - Types of plans – Objectives – Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions.	
UNIT III - ORGANIZING	**(9)**
Nature and purpose of organizing - Organization structure - Formal and informal organization - Line and Staff authority- Departmentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing – Selection and Recruitment - Orientation -Career Development - Career stages – Training - Performance Appraisal.	
UNIT IV - DIRECTING	**(9)**
Creativity and Innovation - Motivation and Satisfaction - Motivation Theories - Leadership – Types of Leadership – Job enrichment - Communication - hurdles to effective communication – Organization Culture - Elements and types of culture - Managing cultural diversity.	
UNIT V - CONTROLLING	**(9)**
System and Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control - Maintenance Control – Quality Control - Planning operations .balance sheet understanding.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Harold Koontz, Heinz Weihrich , “Essentials of Management”, Tata McGrawHill, 8th edition Second Reprint 2010.

REFERENCES:

1. Andrew J. Dubrin, “Essentials of Management”, Thomson Southwestern, 9th ed., 2012.
2. Stephen P. Robbins and Mary Coulter, “Management”, Prentice Hall of India, 10th Edition, 2010.
3. Charles W L Hill, Steven L Mc Shane, “Principles of Management”, Mc Graw Hill Education, Special Indian Edition, 2008.
4. Hellriegel, Slocum & Jackson, “Management - A Competency Based Approach”, Thomson South Western, 10th edition, 2007.
5. Harold Koontz, Heinz Weihrich and Mark V Cannice, “Management - A global & Entrepreneurial Perspective”, Tata Mc Graw Hill, 12th ed., 2007.

17ECC13 - MICROPROCESSOR AND MICROCONTROLLER INTERFACING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17ECC06	**QUESTION PATTERN : TYPE - 1**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	Understand the concepts of internal architecture of Microprocessor and Microcontroller.	**1.1**	The students will be able to apply the basic concepts of peripherals and develop the real time applications	**a,c,d,k**
2.0	Understand the concepts of assembly language programming	**2.1**	The students will be able to program Microprocessor and Microcontroller for different applications using assembly language programming.	**b,c,k**
3.0	Understand the concepts of high level language programming	**3.1**	The students will be able to develop Microcontroller based system using higher level language	**b,c,e,k**
4.0	Illustrate how the different peripherals are interfaced with microcontroller.	**4.1**	The students will be able to design and develop real time applications using Microcontrollers	**b,c,d,k**
5.0	Familiar with the concepts of RISC based Microcontroller architecture	**5.1**	The students will be able to acquire knowledge about peripherals and develop the real time applications	**a,c,d,k**

UNIT I – 8 BIT MICROPROCESSOR & MICROCONTROLLER	**(9)**
Origin and classification of Microprocessor - 8085 Architecture- 8051 Microcontroller: Architecture – Signals – Memory Organization - Interrupts – Timer/counter -Serial communication.	
UNIT II – 8051 ASSEMBLY LANGUAGE PROGRAMMING	**(9)**
8051 Addressing mode – Instruction Set – Programming 8051 Timers – Serial Port programming – Interrupt Programming.	
UNIT III- 8051 HIGH LEVEL LANGUAGE PROGRAMMING	**(9)**
Data types and time delay in 8051 C – I/O Programming in 8051 C – Logical operations in 8051 C – Accessing code ROM space in 8051 C – Timer programming in C – Serial port programming in C – Interrupt programming in C	
UNIT IV - 8051 EXTERNAL INTERFACING	**(9)**
LCD & Keyboard Interfacing - ADC, DAC & LM35 Temperature Sensor Interfacing - External Memory Interface- Stepper Motor Interfacing	
UNIT V- PIC MICROCONTROLLER	**(9)**
PIC 16F877 Microcontroller Architecture - Memory organization -Interrupts Timer/Counter - Compare/Capture/PWM modules (CCP) - Master Synchronous Serial Port module (MSSP).	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011
2. John B Peatman, "Design with PIC Microcontrollers", Pearson Education Asia, 2013, Twenty third Impression.

REFERENCES :

1. Ramesh S. Goankar, "Microprocessor Architecture: Programming and Applications with the8085", Sixth edition, Penram International, 2015 Reprint
2. Ajay V Deshmukh, "Microcontrollers: Theory and Applications", Tata McGraw – Hill, 2012, Twentieth Reprint.
3. Senthilkumar, Saravanan, Jeevanantham, Shan "Microprocessor & Interfacing", Oxford University press, 2012.
4. K.Uma Rao. Andhe Pallavi, "The 8051 Microcontroller Architecture, Programming and Applications" Pearson Education 2011, Second Impression.

17ECC14 - DATA COMMUNICATION AND NETWORKS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : 17ECC06	**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To provide in-depth understanding of the underlying concepts of computer networks.	**1.1**	The students will be able to Comprehend Processes To Communicate With Each Other Across A Computer Networks.	**a,c,g,k**
2.0	To extend the students' knowledge in the areas of multiple access techniques, network protocols.	**2.1**	The students will be able to Analyze The Services, Roles And Features Of The Data Link Layers Of Data Networks.	**a,c,d,i**
3.0	To analysis the upper layers of the OSI model.	**3.1**	The students will be able to Identify solution for each routing/switching functionality at network layer.	**b,c,g,k,l**
4.0	To treat certain key related areas such as performance of internetworking.	**4.1**	The students will be able to Trace the flow of information from one node to another node in the network.	**a,i,k,l**
5.0	To familiar with emerging trends in networking technologies.	**5.1**	The students will be able to Choose the required functionality at each layer for given application.	**a,c,d,h,k**

UNIT I – INTRODUCTION TO COMMUNICATION NETWORKS	**(9)**
Data communications – Networks – Network types - Networking devices : hubs , switches, gateways, repeaters, Bridges and routers - Modem and its types – Internet history – standards and administration- TCP/IP protocol suite- ISO / OSI Reference Model - Transmission Media : Guided Media and Unguided Media, Switching: Circuit switched networks, Packet switched networks.	
UNIT II - DATA LINK LAYER	**(9)**
Introduction –Link layer Addressing - Error Detection & Correction – Block coding – cyclic codes – checksum – Forward Error Correction –DLC services - DLL Protocol – Media access Control – Wired LAN's: Ethernet – ATM - Wireless LAN : IEEE 802.11 – Bluetooth,WiMAX.	
UNIT III - NETWORK LAYER	**(9)**
Network Layer services – Packet Switching –Network Layer performance - IPv4 Addresses- Forwarding of IP Packets- Internet Protocol-ICMPv4-Routing Algorithms - Unicast Routing Protocols - IGMP –Multicast Routing – IPv6 addressing.	
UNIT IV - TRANSPORT LAYER	**(9)**
Introduction - User Datagram Protocol - Transmission Control Protocol – SCTP -- Quality of service – Data flow characteristics – Flow control to improve QoS: Token Bucket and Leaky Bucket.	
UNIT V - APPLICATION LAYER	**(9)**
World wide web and HTTP – FTP- Email – Telnet – SSH- Domain Name System- Cryptography and Network security: Introduction –Confidentiality – Other aspects of Security – Transport layer security: SSL Architecture.	
TOTAL :(L: 45) = 45 PERIODS	

TEXT BOOK:

1. Behrouz A. Forouzan, "Data Communication and Networking", 5th Edition, Tata McGraw-Hill, 2013.

REFERENCES:

1. Tanenbaum, Andrew S and David Wetherall, ―Computer Networks, 5th Edition, PHI Learning, New Delhi, 2010.
2. Kurose, James F. and Ross, Keith W., ―Computer Networking: A Top-Down Approach Featuring the Internet, 6th Edition, Pearson Education, New Delhi, 2012.

17ECC15 - TRANSMISSION LINES AND WAVEGUIDES				
	L	T	P	C
	2	2	0	3
PREREQUISITE : 17ECC10	**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To introduce various types of transmission lines and analyze the lumped circuit model of a transmission line and their characteristics	**1.1**	The student will be able to Interpret the lumped circuit model of a transmission line with circuit theory and determine characteristic impedance, propagation constant and reflection coefficient.	**a,b,c,d,e,h,l,k,l**
2.0	To illustrate the concept of planar transmission lines.	**2.1**	The students will be able to realize E and H field distribution in Microstrip, Strip lines and Coplanar lines and Calculate losses and Q-factor of Microstrip line	**a,b,g,i,l**
3.0	To find SWR, Reflection Coefficient, Return loss and impedance matching.	**3.1**	The students will be able to Compute the SWR, reflection coefficient parameters using smith chart and design single stub matching and double stub matching	**a,b,c,d,e,h,i,k,l**
4.0	To investigate the propagation of electromagnetic waves in Parallel plane waveguides	**4.1**	The students will be able to Deduce the field configuration of parallel plate waveguide.	**a,b,c,g,i,k,l**
5.0	To investigate the propagation of electromagnetic waves in Rectangular waveguides	**5.1**	The students will be able to Deduce the field configuration of rectangular waveguide and resonant cavities	**a,b,c,g,i,k,l**

UNIT I - FILTERS	**(6+6)**
The neper - the decibel -Characteristic impedance of Symmetrical Networks – current and voltage ratios - Propagation constant - Properties of Symmetrical Networks - Filter fundamentals - Pass and Stop bands. Behaviour of the Characteristic impedance. Constant K Filters Low pass, High pass band, pass band elimination filters - m - derived sections –Filter circuit design – Filter performance – Crystal Filters-Two port networks.	
UNIT II - TRANSMISSION LINE THEORY	**(6+6)**
Line Parameters, The transmission line – general solution, Physical significance of the equation, Wavelength and velocity of wave propagation, Waveform distortion, The distortion less line, the telephone cable, Reflection of line not terminated in Z_0- Reflection coefficient, Open circuit and short circuit line, reflection factor and reflection loss, insertion loss.	
UNIT III - IMPEDANCE MATCHING AND TUNING	**(6+6)**
Standing waves – nodes – standing wave ratio, Impedance matching- Half wavelength and Quarter wave transformer, single stub matching. Smith chart - Measurement of VSWR, impedance, single stub and double stub matching problems.	
UNIT IV - GUIDED WAVES BETWEEN PARALLEL PLANES	**(6+6)**
Application of the restrictions to Maxwell's equations – Types of propagation - Transmission of TM waves between Parallel planes – Transmission of TE waves between Parallel planes. Transmission of TEM waves between Parallel planes –Velocities of the waves. Characteristic impedance of plane.	

UNIT V - GUIDED WAVES BETWEEN RECTANGULAR PLANES	(6+6)
Applications of Maxwell's equations to the rectangular waveguide. TM waves in rectangular waveguide. TE waves in rectangular waveguide – Dominant mode in rectangular waveguide-The TEM wave coaxial lines. Excitation modes. Guide termination and resonant cavities. Introduction to circular waveguides	
TOTAL (L: 30+T:30) = 60 PERIODS	

TEXT BOOKS:

1. John D. Ryder, "Network lines and Fields", PHI, Second Edition reprint 2013.
2. F. Olyslager, "Electromagnetic Waveguides and Transmission Lines" Clarandon Press. Oxford reprint 2003

REFERENCES:

1. E.C.Jordan, K.G. Balmain: "E.M.waves & Radiating systems", Pearson education, 2006.
2. Simon Ramo, John R. Whinnery"Fields And Waves In Communication Electronics", Wiley student Edition publications third edition 2008
3. G.S.N. Raju, Electromagnetic Field Theory & Transmission Lines, Pearson Education, 2006
4. Dr.P.Dhananjayan, "Transmission lines and waveguides", Laxmi publication Fifth Edition June 2012.

17ECP08 - MICROPROCESSOR AND MICROCONTROLLER INTERFACING LABORATORY					
		L	T	P	C
		0	0	4	2
PREREQUISITE : 17ECP03		**QUESTION PATTERN : TYPE -NIL**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to learn and practice the basics of 8085 programming concepts	**1.1**	The students will be able to develop applications using 8085 processor program.	**a,b,i**
2.0	To enable the student to analyze the various arithmetic & Logical operations in 8085 processor.	**2.1**	The students will be able to evaluate various arithmetic & Logical operations using 8085 processor.	**b,c,d,k**
3.0	To provide the student with practice in the 8051 microcontroller.	**3.1**	The students will be able to verify the various arithmetic & Logical operations using 8051 controller.	**b,c,d,k**
4.0	To make the students to learn and practice with 8051 peripherals	**4.1**	The Students will be able to verify the basic peripherals in 8051 using HLP.	**c,d,e,k**
5.0	To motivate the students to learn the I/O interfacing concepts in 8051.	**5.1**	The Students will be able to implement the interfacing concepts for various real world applications.	**d,e,f,k**

LIST OF EXPERIMENTS:

Assembly Language Programming:

1. Study of 8085 microprocessor (Addressing modes & Instruction set).
2. Assembly language programming for 8/16 bit Arithmetic operators Using 8085.
3. Assembly language programming with control instructions Using 8085 (Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers.
4. Assembly language programming for arithmetic and logical operations using 8051.
5. Interfacing and Programming of DC Motor Speed control using 8051.
6. Interfacing and Programming of Stepper Motor control using 8051.

High Level Language Programming

The following programs have to be tested on 8051 Development board/equivalenting Embedded C Language on KEIL IDE or Equivalent.

1. Program to toggle all the bits of Port P1 continuously with delay.
2. Program to toggle P1.5 continuously with delay. Use Timer in mode 0, mode 1, mode 2 and mode 3 to create delay using 8051.
3. Program to interface 7 segment display to display a message on it using 8051.
4. Program to interface keypad. Whenever a key is pressed, it should be displayed on LCD using 8051.
5. Program to get analog input from Temperature sensor and display the temperature Value on LCD using ADC with 8051 Microcontroller.
6. Program to handle interrupts with 8051 Microcontroller.

TOTAL (P: 60) = 60 PERIODS

17ECP09 - DATA COMMUNICATION AND NETWORKS LABORATORY					
		L	T	P	C
		0	0	4	2
PREREQUISITE : 17ECP03		**QUESTION PATTERN : TYPE -NIL**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To understand the concepts of computer networks and data transmission.	**1.1**	The students will be able to Obtain the working knowledge of computer hardware & Operating Systems, software and networking skills.	**a,b,c,g,j**
2.0	To understand the peer to peer communication application using different protocols.	**2.1**	The students will be able to Build some simple networking models using the Network simulator modeling tool and perform simulations that help them evaluate their design approaches and expected network performance.	**a,b,g,i,l**
3.0	To analysis the socket programming to build a network application.	**3.1**	The students will be able to Implement and compare the various routing algorithms for wire/wireless networks.	**b,c,e,k,l**
4.0	To get knowledge about the various open source simulation tools for packet tracing and network design.	**4.1**	The students will be able to Master the concepts of protocols, network interfaces and design LAN, MAN and WAN.	**a,e,i,k,l**
5.0	To learn the various routing algorithms and simulation tools.	**5.1**	The students will be able to Troubleshoot and repair network problems.	**b,g,i,k,l**

LIST OF EXPERIMENTS:

1. Performance analysis of stop and wait protocol.
2. Performance analysis of Go back-N protocol.
3. Performance analysis of selective repeat protocol.
4. Performance analysis distance vector routing algorithm & Link state routing algorithm.
5. Performance analysis of Data encryption and decryption.
6. To create scenario Transfer of files from PC to PC using Windows socket processing.
7. Wired LAN protocol. To create scenario and study the performance of CSMA/CD protocol through simulation.
8. Wireless LAN protocols. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
9. Study of Network simulator (NS) and create scenario Ethernet LAN using n nodes (6), change error rate and data rate and compare the throughput using NS-2
10. Constructing the point-to-point networks using network simulator packages – NS2
    a. Simulate the nodes in the network with duplex links between them.
    b. Set the queue size, packet size and packet interval time.

c. Choose suitable link parameters such as link delay and link bandwidth for CBR traffic with UDP / TCP agent and observe the packet dropping phenomena. 11. Capturing data traffic for Protocol Analysis using Sniffer Tools - Wireshark/ NETMON a. Exploring HTTP, DNS b. Exploring TCP, UDP c. Exploring ICMP, ARP, IP d. Exploring Ethernet
TOTAL (P: 60) = 60 PERIODS

17GED08 - ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE					
		L	T	P	C
		2	0	0	0
PREREQUISITE : Nil					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To Understand the basics of Indian tradition and Indian traditional knowledge systems	**1.1**	The students will be able to Gain Knowledge about of Indian tradition and Indian traditional knowledge systems	a,f,h	
2.0	To know about basics of technologies and its scientific perspectives.	**2.1**	The students will be able to Understand basics of technologies and its scientific perspectives.	a, f	
3.0	To study the basics of Indian traditional health care ,	**3.1**	The students will be able to **study the** basics of Indian traditional health care	a,f,l	
4.0	To know the basics of Indian artistic tradition knowledge	**4.1**	The students will be able to **know the** basics of Indian artistic tradition	a,f,l	
5.0	To develop the basics of linguistic tradition	**5.1**	The students will be able To develop the basics of linguistic tradition	a,f,h	

UNIT I - Indian Tradition:	**(6)**
Fundamental unity of India, India's heroic role in world civilization, The Indian way of life, Introduction to Indian tradition, The Scientific Outlook and Human Values.	
UNIT II - Indian Knowledge System and Modern Science:	**(6)**
Relevance of Science and Spirituality, Science and Technology in Ancient India, Superior intelligence of Indian sages and scientists	
UNIT III - Indian Traditional Health Care:	**(6)**
Importance and Practice of Yoga, Pranayam and other prevailing health care techniques	
UNIT IV - Indian Artistic Tradition:	**(6)**
Introduction and overview of significant art forms in ancient India such as painting, sculpture, Civil Engineering, Architecture, Music, Dance, Literature etc	
UNIT V - Indian Linguistic Tradition:	**(6)**
Ancient Indian languages and literary Heritages, Phonology, Morphology, Syntax and Semantics	
TOTAL = 30 PERIODS	

Text Books:

1. Sivaramakrishnan, V., *Cultural Heritage of India- Course Material*, Bharatiya Vidya Bhavan, Mumbai 5th Edition, 2014
2. Swami Jitatmananda, *Modern Physics and Vedanta*, Bharatiya Vidya Bhavan, 2004.
3. Raman V.V., *Glimpses of Indian Heritage,* Popular Prakashan,1993
4. Jha V.N., *Language, Thought and Reality*
5. Krishna Chaitanya, *Arts of India*, Abhinav Publications, 1987.

17ECC16 - ANALOG AND DIGITAL COMMUNICATION				
	L	T	P	C
	3	0	0	3
PREREQUISITE : 17ECC06	**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To provide knowledge on complete analysis of Analog communications.	**1.1**	The students will be able to acquire the knowledge about Analog modulation and demodulation schemes	**a,c,d,i**
2.0	To acquire knowledge about Pulse modulation.	**2.1**	The students will be able to acquire the knowledge about Pulse modulation and demodulation schemes	**b,l,f,j**
3.0	To learn the concepts of noise theory and basics of error control coding.	**3.1**	The students will be able to calculate SNR of various communication systems and perform error control coding.	**a,d,i**
4.0	To analyze the performance of Baseband Transmission.	**4.1**	The students will be able to analyze the methods of baseband data transmission and reception.	**b,c,j,k,**
5.0	To analyze the performance of Pass band Transmission.	**5.1**	The students will be able to analyze the performance of various Pass band data transmission and reception techniques.	**a,e,f**

UNIT I - ANALOG MODULATION SCHEMES	**(9)**
Functional block diagram of communication systems- Linear modulation schemes: Generation of AM: DSBFC using balanced modulator- Introduction to DSBSC, SSBSC and VSB Signals-Comparison of Amplitude Modulation Systems. Principle of frequency and phase modulation– Relation between FM and PM waves–Frequency modulation: Narrowband and wide band FM-Transmission bandwidth of FM.	
UNIT II - PULSE MODULATION SYSTEMS	**(9)**
Pulse amplitude modulation–generation and detection of PWM and PPM-Basic signal processing operations in Digital Communications–Sampling theorem-Quantization: Uniform and Non-uniform (A-law & μ-law) - Pulse code modulation, Differential pulse code modulation, Delta Modulation, Adaptive Delta modulation -Classification of line coding and Decoding.	
UNIT-III - NOISE THEORY AND CODING TECHNIQUES	**(9)**
Types of noise in communication systems, Noise temperature. Noise in CW modulation systems- signal to noise ratio (SNR), noise figure, noise in AM –SSB & FM receivers, pre-emphasis and de-emphasis. Coding Techniques : Shannon- Fano coding, Linear Block Codes.	
UNIT IV - BASEBAND DATA TRANSMISSION AND RECEPTION	**(9)**
Matched Filter –Error rate due to noise –Inter symbol Interference- Nyquist criterion for distortion less base band Binary Transmission-Correlative level coding: Duo binary with and without precoder- Modified duo binary with and without precoder –Eye patterns.	
UNIT V- PASSBAND DATA TRANSMISSION AND RECEPTION	**(9)**
Pass band Transmission model-Generation, detection ,signal space diagram, bit error probability and power spectra of Binary Modulation schemes (ASK,FSK,PSK), Quadrature Modulation schemes (QPSK,QAM) – Comparison of Binary and Quadrature modulation techniques.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Simon Haykin, "Communications Systems", Wiley Education, 4th Edition, 2008
2. T L Singal, "Analog & Digital Communications", Tata McGraw-Hill Education, 4th Edition, 2012

REFERENCES :

1. Taub and Schilling, “Principles of Communication Systems”, McGraw Hill, 3rd Edition, 2007.
2. Wayne Tomasi, “Electronic Communications Systems–Fundamentals Through advanced”, Pearson Education, 4th Edition, 2007.
3. Praokis J.G., “Digital Communications” 4th Edition, McGraw Hill, 2000.
4. Bernard Sklar, Pabitra Kumar Ray “Digital Communications: Fundamentals & Applications”, Pearson Education, 2nd Edition, 2009.

17ECC17 - VLSI DESIGN *(Common to ECE and E&I Branches)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PREREQUISITE : 17ECC13	**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to learn CMOS devices and its manufacturing technology	**1.1**	The students will be able to create models of moderately sized CMOS circuits that realize specified digital functions.	**a,b,c,l,l**
2.0	To enable the student to evaluate the Basic electrical properties of MOS and BICMOS Circuits	**2.1**	The students will be able to identify the interactions between process parameters, device structures, circuit performance, and system design	**a,b,c,e,j**
3.0	To enable the student to design Sub System Design and Layout	**3.1**	The students will be able to apply CMOS technology-specific layout rules in the placement and routing of transistors and Interconnect.	**a,b,d,i,k**
4.0	To motivate the students to implement the Subsystem design and Layout.	**4.1**	The students will be able to complete a significant VLSI design project having a set of objective criteria and design Constraints.	**a,b,c,d,j**
5.0	To make the students to analyze the Ultra fast circuits and systems.	**5.1**	The students will be able to analyze the physical design process of ultra fast circuits and systems	**a,b,c,d,l**

UNIT I - MOS TECHNOLOGY AND DESIGN PROCESS	**(9)**
Basic MOS Transistors – Enhancement and Depletion Mode Transistor Action – nMOS Fabrication – CMOS Fabrication: n-well – p-well – twin tub – Bi CMOS Technology – Transient Response – Rise Time – Fall Time – Stick Diagrams: n MOS Design Style – CMOS Design Style – Design Rules and Layout.	
UNIT II - BASIC ELECTRICAL PROPERTIES OF MOS AND CMOS CIRCUITS	**(9)**
Drain to Source Current Vs Voltage Relationships – MOS Transistor Characteristics – MOS Transistor Transconductance gm and Output Conductance gds – Pass Transistor and The nMOS Inverter – Determination of Pullup to Pull-down Ratio – Alternative forms of Pull-up – The CMOS inverter – Latch up in CMOS Circuits. Types of Power Dissipation- Static and Dynamic Power Dissipation.	
UNIT III- CMOS LOGIC STRUCTURES	**(9)**
Switch Logic – Pass Transistors and Transmission Gates – Gate Logic: The Inverter – Two-input nMOS, CMOS and BICMOS Nand Gates – Two-input nMOS, CMOS and BICMOS Nor Gates – Pseudo nMOS Logic – Dynamic CMOS Logic – Clocked CMOS Logic: CMOS domino Logic – n-p CMOS Logic.	
UNIT IV - CMOS MEMORIES AND CLOCKING	**(9)**
The Dynamic Shift Register stage- A Three transistor Dynamic RAM Cell- A One transistor Dynamic Memory Cell – A Pseudo –static RAM/Register Cell-Four transistor Dynamic and Six-transistor Static CMOS Memory Cells- JK Flip-flop Circuit – D Flip-flop circuit- Forming Arrays of Memory Cells-Building up the Floor plan for a 4 x 4-bit register array-Selection and Control of the 4 x 4-bit register array – Random Access Memory(RAM) Arrays – Two Phase clocking – Charge storage- Dynamic Register Element- A Dynamic shift Register.	

UNIT V- CMOS SUB SYSTEM DESIGN	(9)
Overview of Verilog HDL-Modeling Concepts- Adders: Carry look ahead – Carry Select– Design of multipliers: The Serial - Parallel Multiplier – Braun array – Baugh-Woolley – Pipelined Multiplier Array – Wallace Tree Multiplier.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Neil H.E. Weste , David Harris, "CMOS VLSI Design : A circuits and systems perspective " Pearson Education, 4th Edition, 2015..
2. Douglas A. Pucknell, "Basic VLSI Systems and Circuits", Prentice Hall of India, Third Edition, Reprint 2008.

REFERENCES :

1. John P.Uyemera, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, Reprint 2009.
2. John n Rabaey, Anantha Chandrekasan, Borivoje Nikolic " Digital integrated circuits a design perspective" PHI New Delhi , second Edition
3. Wayne Wolf," Modern VLSI Design – System On Chip", PHI New Delhi Third Edition, 2006.

17ECC18 - ANTENNA AND WAVE PROPAGATION					
		L	T	P	C
		2	0	2	3
PREREQUISITE : 17ECC15	**QUESTION PATTERN : TYPE - 1**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make the students to understand the basic radiation mechanism and antenna parameters.	**1.1**	The students will able to know the basic radiation mechanism and antenna parameters.	**a,b,c,d,j,k,l**
2.0	To make the students to design and characterize the various antenna arrays.	**2.1**	The students will be able to design and characterize the various antenna arrays.	**a,b,c,d,e,j,k,l**
3.0	To make the students to analyze the wire antennas and aperture antennas	**3.1**	The students will be able to analyze the wire antennas and aperture antennas.	**b,c,d,e,f,g,h,j,k,l**
4.0	To make the students to gain knowledge on the measurements of Antenna parameters.	**4.1**	The students will be gain knowledge on the measurements of Antenna parameters.	**b,d,e,g,h,l**
5.0	To make the students to compare the wave propagation and analyse the electromagnetic wave propagated in free space.	**5.1**	The students will be able to compare the wave propagation and analyse the electromagnetic wave propagated in free space.	**b,c,d,f,g,h,j,l**

UNIT I - ANTENNA FUNDAMENTALS	**(6)**
Radiation mechanism - single wire, two wire, dipole and current distribution on thin wire, Radiated field components - Hertzian dipole, Half wave Dipole and Monopole Antenna. Antenna Parameters- Radiation Pattern, Beam Width, Radiation Power Density, Directivity and Gain, Bandwidth, Polarization, Input Impedance, Efficiency, Antenna Effective Length and Area, Antenna Temperature, Reciprocity Principle.	
UNIT II -DESIGN OF ARRAYS	**(6)**
Linear Array - Two element array, N-element linear array- Broadside array, End fire array- Directivity, Pattern Multiplication, Non-uniform excitation- Binomial Array.	
UNIT III-SPECIAL ANTENNAS	**(6)**
Wire Antennas- Small Loop Antenna, V-Antenna, Rhombic antenna, Helical antenna and Yagi-Uda antenna, Frequency Independent Antenna, Horn antenna, Parabolic Reflector antenna, Microstrip antenna, MEMS antenna.	
UNIT IV - ANTENNA MEASUREMENTS	**(6)**
Antenna Measurements: Measurement of antenna impedance - Pattern measurements - Measurement of Antenna Gain - Beam width - Radiation resistance - Antenna efficiency – Directivity – Polarization - Measurement of Noise Figure and Noise Temperature.	
UNIT V- WAVE PROPAGATION	**(6)**
Fundamentals of Free Space Propagation, Ground Wave Propagation, Sky Wave propagation- Structure of ionosphere, Critical frequency, Virtual height , MUF, Skip distance, Effects of earth‟s magnetic fields, Fading, Whistlers, Space Wave Propagation, Duct Propagation.	

LIST OF EXPERIMENTS:

1. Verify the electromagnetic wave propagation in different types of wave guides.
2. Design a rectangular wave guide with given parameters.
3. Design and analyze the radiation pattern of a dipole antenna.
4. Calculate the gain of micro strip patch antenna.
5. Analyze the directivity of a dipole array antenna.

TEXT BOOKS:

1. J.D.Krauss, “Antenna for all Applications”, TMH, Fourth Edition, 2010.
2. K.D.Prasad, “Antenna and Propagation”, Tech India Publications, 2009.

REFERENCES :

1. Balanis, “Antenna Theory - Analysis and Design”, Third Edition, John Wiley & Sons, 2005.
2. R.S.Elliot, “Antenna Theory and Design”, IEEE Press, John Wiley, 2005.

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

17ECP10 - ANALOG AND DIGITAL COMMUNICATION LABORATORY					
		L	T	P	C
		0	0	4	2
PREREQUISITE : 17ECP03					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To demonstrate the concepts of generation and detection of analog modulation schemes	**1.1**	The students will be able to transmit and receive the signal using Analog modulation and demodulation schemes	**a,c,j**	
2.0	To understand the concepts of Emphasis Techniques	**2.1**	The students will be able to analysis the response of pre - Emphasis and de-emphasis	**b,e,i**	
3.0	To demonstrate the concepts of generation and detection of digital modulation schemes	**3.1**	The students will be able to transmit and receive the signal using digital modulation and demodulation schemes	**e,k**	
4.0	To demonstrate the concepts of pulse modulation schemes	**4.1**	The students will be able to transmit and receive the signal using Analog and digital pulse modulation and demodulation schemes	**a,d,g**	
5.0	To acquire the knowledge about error control coding using MATLAB	**5.1**	The students will be able to apply the Error control coding techniques using MATLAB in communication	**e,f**	

LIST OF EXPERIMENTS:

1. Generation and Detection of Amplitude modulation signals.
2. Generation and Detection of Frequency Modulation.
3. Response of Pre-Emphasis / De-emphasis Circuits.
4. Sampling process: Generation of Pulse Modulation waveforms–PAM / PWM / PPM.
5. Generation of Line Coding and Decoding techniques.
6. Generation and detection of digital modulation schemes- ASK, PSK, FSK.
7. Generation and detection of QPSK waveforms.
8. Generation and detection of Delta Modulation waveforms.
9. Implementation of Pulse Code modulation/TDM for digital input.
10. Implementation of DSB modulator and demodulator.
11. Implementation of Error control coding using MATLAB.
12. Analysis of PLL and Frequency synthesizer.

TOTAL (P: 60) = 60 PERIODS

17ECP11 - VLSI DESIGN LABORATORY				
L	T	P	C	
0	0	4	2	

PREREQUISITE : 17ECP08

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To gain expertise in design, development and simulation of Combination Logic Circuit using Verilog HDL	**1.1**	Design and simulation of Combination Logic Circuit using Verilog HDL.	**a,b,c,d,e,l**
2.0	To enable the student to design and analyze Sequential Logic Circuit using Verilog HDL	**2.1**	Design and simulation of Sequential Logic Circuit using Verilog HDL.	**a,b,c,d,e,l**
3.0	To provide the student with practice in the Tanner spice	**3.1**	Design, Simulate and Extract the layouts of Analog IC Blocks using Tanner spice.	**a,b,c,d,e,g,l**
4.0	To make the students to learn and analyze transient characteristics response	**4.1**	Analyze transient characteristics.	**a,b,c,d,e**
5.0	To motivate the students to implement the logic modules into FPGA boards	**5.1**	Import the logic modules into FPGA boards.	**a,b,c,d,e,g,h,l**

LIST OF EXPERIMENTS:

I. Design and simulation of Combinational Logic Circuit using Verilog HDL

1. Adder – Carry Select & Carry Save
2. Multiplexer and Demultiplexer
3. Encoder and Decoder
4. Multiplier – Array, Braun Array & Baugh Wooley

II. Design and simulation of Sequential Logic Circuit using Verilog HDL

5. Flip-flops
6. Counters
7. Shift Registers
8. Frequency Dividers

III. **CMOS Circuit design using SPICE (DC and Transient Analysis)**

9. CMOS Inverter
10. CMOS NAND and NOR Gates
11. CMOS Latch

IV.	**FPGA Implementation** 12. 4 bit Adder 13. 4x4 Multiplier 14. ALU Design
	TOTAL (P: 60) = 60 PERIODS

17GED06 - COMPREHENSION				
	L	T	P	C
	0	0	2	0

PREREQUISITE : ALL CORE SUBJECT

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.	**1.1**	The Student will be able to Understand and comprehend any given problem related to Electronics and communication Engineering field.	**a,b**

METHOD OF EVALUATION:	**(30)**
The student will be assessed for his understanding of the basic principles of the core engineering subjects. The internal assessment for a total of 50 marks will be evaluated by a committee comprising of the faculty members of the department. The committee will conduct three written examinations of objective question type from the subjects (Test1-Electronic Devices, Analog Circuits and Digital Circuits; Test 2- Networks, Signals and Systems and Microprocessor; Test 3- Electromagnetics, Communications, VLSI and Digital Signal Processing (DSP)). The end semester examination, which carries a total of 50 marks, will be an objective question type examination conducted by a committee of one internal examiner appointed by the COE of our college.	
TOTAL (P: 30) = 30 PERIODS	

REFERENCES:

1. Dr.Sanjay Sharma “Electronics and Communication Engineering,” 2nd Edition, S.K.Kataria & Sons Publication, New Delhi, 2013.
2. G.K.Mithal: “Electronics and Telecommunication Engineering” G.K.Publications, Noida, 2009.

17GED07- CONSTITUTION OF INDIA					
		L	T	P	C
		2	0	0	0
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To educate about the Constitutional Law of India	**1.1**	The students will be able to Gain Knowledge about the Constitutional Law	f, h, l	
2.0	To motivate students to Understand the Fundamental Rights and Duties of a citizen	**2.1**	The students will be able to Understand the Fundamental Rights and Duties of a citizen	f, g, h	
3.0	To make students to understand about Federal structure of Indian Government	**3.1**	The students will be able to Apply the concept of Federal structure of Indian Government	f, g, h	
4.0	To understand about Amendments and Emergency provisions in the Constitution	**4.1**	The students will be able to Analyze the Amendments and Emergency provisions in the Constitution	f, g, h	
5.0	To educate a holistic approach in their life as a Citizen of India	**5.1**	The students will be able Develop a holistic approach in their life as a Citizen	f, h, l	

UNIT I - Introduction to Indian Constitution	**(6)**
Meaning of the constitution law and constitutionalism - Historical perspective of the Constitution - Salient features and characteristics of the Constitution of India	
UNIT II - Fundamental Rights	**(6)**
Scheme of the fundamental rights - Right to Equality - Fundamental Right under Article 19 - 102 Scope of the Right to Life and Liberty - Fundamental Duties and its legal status - Directive Principles of State Policy – Its importance and implementation	
UNIT III - Federal Structure	**(6)**
Federal structure and distribution of legislative and financial powers between the Union and the States - Parliamentary Form of Government in India - The constitutional powers and status of the President of India	
UNIT IV - Amendment to Constitution	**(6)**
Amendment of the Constitutional Powers and Procedure - The historical perspectives of the constitutional amendments in India	
UNIT V - Emergency Provisions	**(6)**
National Emergency, President Rule, Financial Emergency Local Self Government – Constitutional Scheme in India	
TOTAL = 30 PERIODS	

REFERENCES:

1. Constitution of India - Ministry of Law & Justice – PDF format awmin.nic.in/coi/coiason29july08.pdf
2. Introduction to the Constitution of India by Durgadas Basu
3. The Constitution of India – Google free material - www.constitution.org/cons/india/const.html

17ECC19 - MICROWAVE ENGINEERING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17ECC18		**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To understand and gain complete knowledge about microwave devices	**1.1**	The students will be able to calculate the power distribution in microwave components	**a,b,c,d,j,l**
2.0	To enhance the basic knowledge about the microwave and its systems.	**2.1**	The students will be able to analyze the different types of microwave tubes	**a,b,f,g**
3.0	To provide the basic concepts of microwave networks.	**3.1**	The students will be able to compute the impedance and loss measurements	**a,b,c,d,e,j,l**
4.0	To develop an ability to understand the basic source of communication systems.	**4.1**	The students will be able to identify the various microwave semiconductor devices and its characteristics	**a,b,c,e,l**
5.0	To apply the concept microwave and its systems on various applications.	**5.1**	The students will be able to formulate the application of microwave systems.	**a,b,c,e,j,l**

UNIT I - MICROWAVE NETWORK THEORY AND PASSIVE COMPONENTS	**(9)**
Introduction to Microwave Engineering-Scattering or S matrix representation of multiport Network-Properties of S-parameters - Relations between Z,Y and ABCD parameters with S parameter-Microwave hybrid circuits- S Matrix of Waveguide Tees-Directional Couplers - S Matrix of a Directional Coupler -Microwave Isolator.	
UNIT II – MICROWAVE LINEAR BEAM & CROSSED FIELD TUBES	**(9)**
Klystrons-Velocity Modulation Process-Bunching Process-Two cavity Klystron- Reflex Klystron -Helix Traveling-Wave Tubes-Crossed field device –Magnetron Oscillators.	
UNIT III- MICROWAVE MEASUREMENTS	**(9)**
Spectrum Analyzer-Insertion loss and attenuation measurements-VSWR measurement-impedance measurement-Slotted line method-Frequency Measurement-Microwave Antenna measurement.	
UNIT IV - MICROWAVE SEMICONDUCTOR DEVICES	**(9)**
Transferred Electron Devices-Gunn Diodes - Avalanche time transit devices-Read Diode-IMPATT Diodes-TRAPATT Diode-BARITT Diode –Parametric Devices- Manley –Rowe Power Relations.	
UNIT V- APPLICATIONS OF MICROWAVE SYSTEMS	**(9)**
Microwave Radar Systems:-The Radar Equation-Pulsed Radar-Doppler Radar-Radar Cross Section-Industrial application of Microwaves-Microwave heating-Industrial control and measurements-Medial Applications-Hazards of Electromagnetic Radiation.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Annapurna Das and Sisir K-Das,"Microwave Engineering" Tata McGraw-Hill 2013
2. David M Pozar, " Microwave Engineering" , John Wiley & Sons, 2nd Edition, 2003

REFERENCES:

1. R-E-Collin, "Foundations for Microwave Engineering", IEEE Press 2nd Edition, 2002
2. Samuel Y-LIAO, "Microwave Devices and Circuits", Pearson/Prentice Hall of India,3rdEdition Reprint 2011.

17ECC20 - OPTICAL COMMUNICATION					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17ECC16		**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to learn and understand the basic concepts in optical fiber cable.	**1.1**	The Students can understand the structure of optical fibers and wave propagation mechanisms.	**a,b,l**
2.0	To enable the students to gain knowledge on different losses encounter by an optical cable.	**2.1**	The Students will be able to obtain the knowledge on the losses and dispersions occurred in the optical cable.	**a,b,c,g,l**
3.0	To enable the student to design the optical sources and detectors.	**3.1**	The Students will be able to characterize the Optical sources and detectors.	**b,f,h,i,k,l**
4.0	To motivate the students to identify the problems occur in receiver section.	**4.1**	The students will be able to Calculate the link budget analysis of optical receiver section.	**b,e,g,j**
5.0	To make the students to familiar with design considerations of fiber optic systems.	**5.1**	The Students can familiar with design considerations of fiber optical system.	**c,e,g,h,j**

UNIT I - OPTICAL FIBERS - STRUCTURE	**(9)**
Evolution of Fiber Optic Systems , Elements of an Optical fiber Transmission link , Basic laws and definitions, Optical fiber modes and configurations , Mode theory of circular waveguides - Overview of modes, Key modal concepts , Linearly Polarized waves , Single Mode and Multi Mode Fibers, Graded Index Fiber Structure.	
UNIT II - ATTENUATION AND DISPERSION	**(9)**
Attenuation, Signal dispersion in fibers – Overview of Dispersion origins, Modal Delay, Group delay , material dispersion , Wave Guide dispersion , Dispersion in single mode fibers, Polarization mode dispersion , RI profile and cut off wavelength, Dispersion Management, Dispersion Shifted Fibers.	
UNIT III- OPTICAL SOURCES	**(9)**
LED's - Surface and Edge emitters, Modulation of LED, LASER Diodes - Fabry-Perot Lasers , Distributed Feedback (DFB) Lasers , Modulation of LASER diodes , Power Launching and Coupling - Source to fiber power launching , Lensing Schemes for Coupling improvement , LED coupling to single mode fibers, Fiber connectors, Fiber splicing.	
UNIT IV - PHOTODETECTOR AND OPTICAL RECEIVER OPERATION	**(9)**
PIN Photo detector, Avalanche Photodiodes, Photodetector noise - Detector response time, Avalanche multiplication of Noise, Fundamental Receiver operation-Error sources, Front End Amplifiers, Digital Receiver Performance-Probability of error, Quantum limit, Point to point link systems considerations - Link Power budget, Rise time budget..	
UNIT V- OPTICAL NETWORKS AND PERFORMANCE MEASUREMENTS	**(9)**
Operational principles of WDM, EDFA''s, Solitons, Basic concepts of SONET/SDH, Performance Measurement-Measurement standards, Test Equipments, Power Measurements, Attenuation Measurements, Dispersion Measurements, OTDR.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Gerd Keiser, "Optical Fiber Communications", McGraw-Hill Education, 5th Edition, 2013.

REFERENCES:

1. John M. Senior, "Optical Fiber Communications", Pearson Education, 3rd Edition, 2009.
2. Govind P.Agrawal, "Fiber-optic Communication Systems", A John Wiley & Sons, 3rd Edition, 2004.
3. R.P.Khare, "Fiber Optics and Optoelectronics", Oxford University, 2007.

17ECC21 - EMBEDDED AND REAL TIME SYSTEMS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17ECC13	**QUESTION PATTERN : TYPE - 1**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	Learn the architecture and programming of ARM processor	**1.1**	The students will be able to Describe the architecture of different ARM processor cores.	**a,b,f,i,k**
2.0	Be familiar with the embedded computing platform design and analysis.	**2.1**	The students will be able to Understand the instruction set and Assembly Language Programming in ARM.	**a,c,f,j**
3.0	Be exposed to the basic concepts of real time Operating system.	**3.1**	The students will be able to Categorize and understand the recent trends in Embedded Systems.	**a,d,i,k**
4.0	Learn the system design techniques and networks for embedded systems.	**4.1**	The students will be able to Outline the concepts of embedded systems and explain the basic concepts of real time Operating system design.	**a,b,f,k**
5.0	To make the students to develop the real time solutions	**5.1**	The students will be able to Develop real time solutions in different RTOS environment.	**a,b,c,i,l**

UNIT- I ARCHITECTURE OF EMBEDDED SYSTEMS	**(9)**
Categories of Embedded Systems- Specialties of Embedded systems-Recent trends in Embedded Systems-Hardware Architecture-Software Architecture-Communication software-Process of generation of executable image-development/testing tools.	
UNIT-II THE ARM RISC ARCHITECTURE	**(9)**
The Reduced Instruction Set Computer – Architectural inheritance-The ARM programmers model - ARM Development Tools.-ARM organization and implementation: 3 stage and 5 stage pipeline ARM organization-ARM instruction execution- ARM processor cores: ARM7 TDMI- Comparison of ARM8 TDMI-ARM9 TDMI.	
UNIT-III ARM INSTRUCTION AND ASSEMBLY LANGUAGE PROGRAMMING	**(9)**
Exceptions-Conditional execution-Branch and branch with link and exchange-Software interrupt-Data processing instructions-Single word and unsigned byte data transfer and half word and signed byte data transfer instructions-Multiple register transfer instructions-Swap instructions-The thumb instruction set - Thumb applications.	
UNIT-IV RTOS CONCEPTS	**(9)**
Architecture of the Kernel-task and task scheduler-Interrupt Service Routines-Semaphores-Mutex- Mailboxes-Message Queues-Event Registers-Pipes-Signals-Timers-Memory Management – Priority Inversion Problem.	
UNIT V- RTOS IMPLEMENTATION	**(9)**
Off the shelf operating system – embedded operating system – Real time operating system:VX works- Micro C/OS-II hand held operating system : Palm OS- Symbian OS - Case study of coding for an Automatic Chocolate Vending Machine using MUCOS -RTOS- Case study of an Embedded system for an Adaptive Cruise Control Systems in a Car- Case study of an Embedded Systems for a Smart Card.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Dr.K.V.K.K Prasad "Embedded Real-Time systems: concept, design & Programming" Dream tech Press, Reprint Edition, 2010.
2. Steve furber "ARM system On Chip Architecture" Pearson 16th Edition 2013

REFERENCES :

1. Raj Kamal "Embedded Systems Architecture Programming and Design" 2nd Edition TMH, 2010
2. Wayne Wolf, "Computers as Components - Principles of Embedded Computer System Design", Morgan Kaufmann Publisher, 2nd Edition 2006.

17ECP12 - MICROWAVE AND OPTICAL LABORATORY					
		L	T	P	C
		0	0	4	2
PREREQUISITE:17ECP10		**QUESTION PATTERN : TYPE -NIL**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to apply knowledge of optical communication to various application areas.	**1.1**	The Students can apply knowledge of optical communication to various application areas.	**a,d,j,l**
2.0	To enable the student to implement and maintain the various microwave components.	**2.1**	The Student will be able to implement and maintain the various microwave components.	**a,b,c,d,j,l**
3.0	To provide the student to solve problems in maintaining the optical and microwave components.	**3.1**	The Students will be able to solve problems in maintaining the optical and microwave components.	**a,b,c,d,l**
4.0	To make the students to learn and calculate the numerical aperture of a fiber.	**4.1**	The students can obtain knowledge to calculate the numerical aperture of a fiber.	**a,b,f,l**
5.0	To motivate the students understand the characteristics of Gunn diode and Reflex Klystron.	**5.1**	The Students can understand the characteristics of Gunn diode and Reflex Klystron.	**a,b,f,g,l**

LIST OF EXPERIMENTS:

Microwave Lab Experiments:

1. Mode Characteristics of Reflex Klystron.
2. Measurement of standing wave ratio and reflection coefficient.
3. V-I characteristics of Gunn diode oscillator.
4. Measurement of frequency & wavelength in a rectangular waveguide Working on TE10 mode
5. Impedance measurement using slotted line method.
6. Radiation pattern of a Horn Antenna.

Optical Experiments:

1. Measure the Numerical Aperture of Optical Fiber
2. DC Characteristics of LED and Photo detector.
3. Characteristics of optical signal using analog and digital link.
4. Measurement of system bandwidth by intensity modulation using optical fiber.
5. Measurement of attenuation in a single mode fiber.
6. Mode characteristics of fiber.

TOTAL (P: 60) = 60 PERIODS

17ECP13 - EMBEDDED SYSTEMS LABORATORY			
L	T	P	C
0	0	4	2

PREREQUISITE : 17ECP08 | **QUESTION PATTERN : TYPE -NIL**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To obtain a broad understanding of the emerging technologies in embedded system	**1.1**	The students will be able to Develop applications using I/O ports in Microcontrollers	**a,c,d,k**
2.0	To acquire knowledge on 8bit Microcontroller and interfacing.	**2.1**	The students will be able to Design embedded systems with wireless applications	**b,c,d,k**
3.0	To gain knowledge about automation using embedded systems.	**3.1**	The students will be able to Design system for real world applications using peripherals.	**b,c,e,k**
4.0	To gain knowledge about wired networks	**4.1**	The students will be able to Design embedded systems using wired protocols.	**b,c,e,k**
5.0	To gain knowledge about I/O models	**5.1**	The students will be able to Made automation and provide solution to problems in design	**a,d,f**

LIST OF EXPERIMENTS:

1. Study the function of I/O ports of ARM Processor and Program to control the external devices using GPIO ports.
2. Program to interface 7 segment display to display a message on it using ARM Processor.
3. Program to interface the stepper motor and control the direction of rotation using ARM Processor.
4. Study the function of I/O ports of an Arduino & Design a Heart Beat sensor.
5. Design a fire sensor system using Arduino controller.
6. Study the function of I/O ports of PIC16FXX Microcontroller and Program to control the external devices using GPIO ports.
7. Program to interface Traffic Light Controller using PIC Microcontroller.
8. Study the basic Linux commands in Raspberry pi & install the Operating systems for RPi in a SD card preparation and configure the Raspberry Pi during first booting.
9. Program to control the external devices with GPIO using Raspberry pi.
10. Interfacing and Programming of Sensors using Raspberry pi.

TOTAL (P: 60) = 60 PERIODS

17ECD01 – PROJECT WORK-I			
L	T	P	C
0	0	8	4

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE -NIL**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To practice the fundamental electronics engineering concepts and principles in addressing a real time situation autonomously or in a team.	**1.1**	The students will be able to study problems in the field of Electronics and communication Engineering through literature survey and its reviews.	**a,b,e,f**
2.0	To develop an ability to solve problem by making a literature review and finding a solution for the same.	**2.1**	The students will be able Undertake problem identification, formulation and solution.	**a,b,e,f**
3.0	To Study various types of methodology based on the problem.	**3.1**	The students will be able to Design engineering solutions to complex problems utilising a systems approach and develop projects	**a,c,d,f,i**
4.0	To create platform to communicate and present the ideas in written and oral form	**4.1**	The students will be able to Communicate effectively and to present ideas clearly	**a,c,d,g,j**
5.0	To create a team work to exhibit the knowledge and skills to contribute to the society.	**5.1**	The students will be able to demonstrate the knowledge, skills and work as a team to achieve common goal	**c,d,f,h**

DESCRIPTION

Project work may be allotted to a single student or to a group of students not exceeding 4 per group. The title of project work is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations

TOTAL (P: 120) = 120 PERIODS

17ECD02 – PROJECT WORK-II			
L	T	P	C
0	0	16	8

PREREQUISITE : 17ECD01 | **QUESTION PATTERN : TYPE -NIL**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To practice the fundamental electronics engineering concepts and principles in addressing a real time situation autonomously or in a team.	**1.1**	The students will be able to study problems in the field of Electronics and communication Engineering through literature survey and its reviews.	**a,b,e,f**
2.0	To develop an ability to solve problem by making a literature review and finding a solution for the same.	**2.1**	The students will be able Undertake problem identification, formulation and solution.	**a,b,e,f**
3.0	To Study various types of methodology based on the problem.	**3.1**	The students will be able to Design engineering solutions to complex problems utilising a systems approach and develop projects	**a,c,d,f,i**
4.0	To create platform to communicate and present the ideas in written and oral form	**4.1**	The students will be able to Communicate effectively and to present ideas clearly	**a,c,d,g,j**
5.0	To create a team work to exhibit the knowledge and skills to contribute to the society.	**5.1**	The students will be able to demonstrate the knowledge, skills and work as a team to achieve common goal	**c,d,f,h**

DESCRIPTION

Project work may be allotted to a single student or to a group of students not exceeding 4 per group. The title of project work (same title as in project work-I if the same project is continued in project work-II or the title will be selected based on different project) is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations.

TOTAL (P: 240) = 240 PERIODS

17ECX01- MEDICAL ELECTRONICS *(Common to ECE, EEE and E&I Branches)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To learn Bio potential recorders and its signal characteristics.	**1.1**	The students will be able to gain knowledge about the Bio potential recording systems and its signal features.	**a,b,c,d,j,l**
2.0	To be aware of Electrical and Non Electrical Parameter Measurements	**2.1**	The students will be able to learns various Non Electrical Parameters for advance analysis	**a,b,c,d,l**
3.0	To understand basic principles and phenomena in the area of medical diagnostic instrumentation	**3.1**	The students will be able to identify various diagnostic equipments and its applications	**a,b,c,d,j,l**
4.0	Categorize various techniques involved in healing of the disease and its applications	**4.1**	The students will be able to analyze and evaluate the effect of different therapeutic methods, their risk potential, physical principles, opportunities and possibilities for different medical procedures	**a,b,c,j,l**
5.0	To study the concept of advanced medical instrumentation	**5.1**	The students will be able to understand the elements of risk for different instrumentation methods and basic electrical safety	**a,b,c,f,j**

UNIT I - ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING	**(9)**
Anatomy of Human body, Cell Structure, Origin of Bio-potentials; Bio-potential electrodes, Biological amplifiers, ECG, EEG,EOG,EMG lead systems and recording methods, typical waveforms and signal characteristics.	
UNIT II -NON ELECTRICAL PARAMETER MEASUREMENT	**(9)**
Colorimeter, Auto analyzer, Blood flow meter, Cardiac output, Respiratory measurement, Blood pressure, Temperature and Pulse measurement, Measurement of PCO2- Measurement of PO2,Blood Cell Counters	
UNIT III -DIAGNOSTIC EQUIPMENTS	**(9)**
Ultrasound and MRI machines, Positron Emission Tomography, CT scanner-Applications, X-ray machine- Production of X-ray, Types and Uses.	
UNIT IV - THERAPEUTIC EQUIPMENTS	**(9)**
Defibrillator, Cardiac pacemaker, Dialyzer, Heart lung machine, Diathermies-Surgical Diathermy and their applications.	
UNIT V - ADVANCED TECHNIQUES IN MEDICAL INSTRUMENTATION	**(9)**
Telemetry principles, Frequency selection, Biotelemetry, Radio pill, Endoscopy unit, Remote sensing-Continuous patient monitoring system, Lasers in medicine, Electrical safety in medical devices.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. John G.Webster, “Medical Instrumentation Application and Design”, Wiley India,3rd Edition, 2015.

REFERENCES:

1. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, Tata Mc Graw-Hill, New Delhi, 3rd Edition, 2014.
2. Joseph J.Carr and John M.Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and Sons, New York, 4th Edition, 2001.
3. www.rch.org.au/bme_rch/electrical_safety
4. omicsonline.org/a-hospital-healthcare-monitoring-system-using-wirelesshttp://europepmc.org/backend/ptpmcrender.fcgi?accid=PMC1413324&blobtype=pdf

17ECX02 - NANO ELECTRONICS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To learn the basic concepts of nano electronics and nano technologies	**1.1**	The student will be able to Know the basics of nano electronics.	**a,b,f,i,k**
2.0	To learn about silicon MOSFETS, quantum transport devices, carbon nano tubes and its applications.	**2.1**	The student will be able demonstrate carbon nano tubes.	**a,c,f,j**
3.0	To study about molecular electron devices and its applications.	**3.1**	The student will be able to discuss the various applications of nanobiology	**a,d,i,k**
4.0	To study about nanosensors.	**4.1**	The student will be able to describe the properties of nanosensors.	**a,b,f,k**
5.0	To learn the different nanomedicines and nanodrugs.	**5.1**	The student will be to summarize how nanomedicines can impact the future	**a,b,c,i,l**

UNIT I – INTRODUCTION AND EXPERIMENTAL METHODS OF NANOELECTRONICS	**(9)**
Nano and nature – Nano the beginning – Electron microscope – scanning probe microscope – optical microscope – other kinds of microscope –X-Ray diffraction –associated techniques.	
UNIT II - CARBON NANOTUBES	**(9)**
Synthesis and purification – filling of nanotubes – mechanism of growth – electronic structure – transport properties – mechanical properties – physical properties – application – nanotubes of other materials – carbon nanotube FET.	
UNIT III - NANOBIOLOGY	**(9)**
Interaction between biomolecules and nanoparticle surfaces – different types of inorganic materials used for the synthesis of hybrid nano-bio assemblies – applications of nano in biology –nanoprobes for analytical applications.	
UNIT IV – NANOSENSORS	**(9)**
Sensor – nanosensor – nanoscale organization for sensors –characterization – perception –nanosensors based on quantum size effects – electrochemical sensors – sensors based on physical properties – nanobiosensors.	
UNIT V - NANOMEDICINES	**(9)**
Approach to developing nanomedicines – various kinds of nanosystems in use – protocols for nanodrug administration – nanotechnology in diagnostic application – materials for use in therapeutic applications.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. T.Pradeep, NANO: The Essentials – Understanding Nanoscience and Nanotechnology,Tata McGraw Hill education private limited, 2012..

REFERENCES :

1. Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, Nanotechnology: Basic Science and Emerging Technologies, Chapman & Hall / CRC, 26-Feb-2014
2. Rainer Waser (Ed.), Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, Wiley-VCH, 2012

17ECX03 - RADAR AND NAVIGATIONAL AIDS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To understand and gain complete knowledge about radar	**1.1**	The students will be able to gain knowledge radar.	**a,d**
2.0	To enhance the basic knowledge about pulse Doppler radar.	**2.1**	The students will be able to understand the pulse Doppler radar operations.	**c,e**
3.0	To provide the basic concepts of radar navigation.	**3.1**	The students will be able to Understand the principles of navigation in addition to approach and landing aids.	**c,d,e**
4.0	To develop an ability to understand the basics of clutter.	**4.1**	The students will be able to learn about clutter.	**c,d,f**
5.0	To apply the concept of radar in military applications.	**5.1**	The students will be able to apply the concept of radar in various fields.	**f,i**

UNIT I – INTRODUCTION TO RADAR	**(9)**
Basic Radar –The simple form of the Radar Equation– Radar Block Diagram – Radar Frequencies – Applications of Radar– The origins of Radar–Radar Equations: Integration of radar pulses– Radar cross section of targets– Radar cross section fluctuations.	
UNIT II – MTI AND PULSE DOPPLER RADAR	**(9)**
Introduction to Doppler and MTI Radar–Delay Lines Cancellers– Staggered Pulse Repetition Frequencies –Doppler Filter Banks–Digital MTI Processing – Moving Target Detector – MTI from a Moving Platform (AMIT) – Pulse Doppler Radar .	
UNIT III – TRACKING RADAR	**(9)**
Tracking with Radar – Monopulse Tracking– Conical Scan And Sequential Lobing– Limitations To Tracking Accuracy–Low Angle Tracking –Tracking In Range – Other Tracking Radar Topics– ADT	
UNIT IV – RADAR CLUTTER	**(9)**
Introduction to radar clutter –surface clutter radar equation –land clutter–sea clutter– statistical models for surface clutter–weather clutter– detection of targets in clutter.	
UNIT V – RADAR TRANSMITTERS AND RECEIVERS	**(9)**
Radar Transmitters : Introduction - Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources - Other aspects of Radar Transmitter. Radar Receivers - The Radar Receiver - Receiver noise Figure - Superheterodyne Receiver.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Merrill I. Skolnik ," Introduction to Radar Systems", Tata McGraw-Hill (3rd Edition) 2008.

REFERENCES:

1. Peyton Z. Peebles: "Radar Principles", Johnwiley, 2007.
2. J.C Toomay, “Principles of Radar", 2nd Edition – prentice hall, 2004.
3. N.S.Nagaraja, Elements of Electronic Navigation Systems, 2nd Edition, Tata McGraw-Hill, 2006.

17ECX04 - SENSORS AND ITS APPLICATIONS			
L	T	P	C
3	0	0	3

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE - 1**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To know basic concepts of various sensors and transducers.	**1.1**	The Students will become expertise in the basic concepts of various sensors and transducers.	**a,b,c,f**
2.0	To identify various the various transducers used for various applications.	**2.1**	The Students will be able to identify a particular transducer for a specific application.	**b,c,f**
3.0	To know the use of sensors and transducers in the field of instrumentation.	**3.1**	The Students will be able to analyze the performance of thermal, gas and acoustic sensors	**b,e,g,i**
4.0	To know many modern devices and technologies used in sensors.	**4.1**	The Students will be able to analyze the performance of magnetic and inductance sensors	**c,e,h**
5.0	To develop knowledge in selection of suitable sensor based on requirement and applications	**5.1**	The Students will be able to analyze the performance of automobile, home appliance and aerospace sensors	**b,c,f,h**

UNIT I - INTRODUCTION	**(9)**
Definition, classification, static and dynamic parameters, Characterization – Electrical, mechanical, thermal, optical, biological and chemical, Classification of errors – Error analysis, Static and dynamic characteristics of transducers, Performance measures of sensors.	
UNIT II - MECHANICAL AND ELECTRO MECHANICAL SENSORS	**(9)**
Resistive Potentiometer, strain gauge, Inductive sensors and transducer, capacitive sensors, ultrasonic sensors	
UNIT III- THERMAL SENSOR	**(9)**
Thermal Sensors: Gas thermometric sensors, acoustic temperature sensors, magnetic thermometer, resistance change -type thermometric sensors, thermo EMF sensors, junction semiconductor types.	
UNIT IV - MAGNETIC SENSOR	**(9)**
Magnetic Sensors: Force and displacement Sensors, magneto resistive sensors, Hall Effect sensor, Inductance and eddy current sensors, Angular/rotary movement transducer, Electromagnetic flow meter, squid sensor.	
UNIT V- SENSORS AND THEIR APPLICATIONS	**(9)**
Automobile sensor, Home appliance sensor, Aerospace sensors, sensors for manufacturing, medical diagnostic sensors, environmental monitoring.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Patranabis D, “Sensor and Transducers”, Prentice Hall of India (Pvt) Ltd., 2013.

REFERENCES :

1. Ian Sinclair, “Sensor and Transducers”, Elsevier India Pvt Ltd, 3rd Edtion, 2011.
2. A.K. Sawhney, Puneeth sawhney, “A Course in Electrical and Electronic Measurements and Instrumentation”, Dhanpat Rai Publications, 2012.
3. Ernest O. Doeblin, “Measurement System, Application and Design”, Tata McGraw Hill Publishing Company Ltd., 5 th Edition, 2008.

17ECX05 - MEMS AND ITS APPLICATION					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE - 1**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To acquire basic knowledge about application of MEMS in RF communications.	**1.1**	The student will be able to Know the fabrication methodology used in MEMS.	**a,b,f,i,k**
2.0	To study about MEMS physical modelling and reconfigurable elements.	**2.1**	The student will be able Analyze about MEMS materials and its Fabrication techniques.	**a,c,f,j**
3.0	To study about MEMS Switches and mechanisms.	**3.1**	The student will be able to discuss recent advancements in the field of MEMS and its Switches	**a,d,i,k**
4.0	To understand MEMS Inductors and Capacitors.	**4.1**	The student will be able to utilize the materials for common micro components and devices	**a,b,f,k**
5.0	To learn about integration and packaging of RF MEMS devices.	**5.1**	The student will be to analyze the integration and packaging of RF MEMS devices	**a,b,c,i,l**

UNIT I - MEMS AND ITS FUNDAMENTAL DEVICES	**(9)**
MEMS Overview-Micro fabrication for MEMS: Bulk Micromachining, Wafer bonding, Surface Micromachining, , LIGA process, Micromachining of polymeric MEMS devices. Electromechanical transducers: Piezoelectric Transducers, Elctrostrictive Transducers, Magnetostrictive Transducers, Electrostatic actuators, Electromagnetic Transducers and Electrodynamic Transducers.Nano and nature – Nano the beginning – Electron microscope – scanning probe microscope – optical microscope – other kinds of microscope –X-Ray diffraction –associated techniques.	
UNIT II - MEMS MATERIALS AND FABRICATION TECHNIQUES	**(9)**
Metals-semiconductors-thin films for MEMS and their deposition techniques-materials for polymer MEMS: Classification of polymers, UV radiation curing, SU-8 for polymer MEMS. Bulk micromachining for silicon-based MEMS-Silicon surface micromachining.	
UNIT III - MEMS SWITCHES	**(9)**
Switch parameters-Basics of switching-Switches for RF and microwave applications-Actuation mechanisms for MEMS devices-Dynamics of switch operation-MEMS switch design, modeling and evaluation- MEMS switch design considerations.	
UNIT IV - MEMS INDUCTORS AND CAPACITORS	**(9)**
MEMS Inductors: self and mutual inductance, micro machined inductors, modelling and design issues of planar inductors, variable inductor and polymer based inductor. MEMS Capacitors: MEMS gap tuning capacitor, MEMS area tuning capacitor, Dielectric Tunable capacitors.	
UNIT V - INTEGRATION AND PACKAGING OF RF MEMS DEVICES	**(9)**
Role of MEMS Packages: Mechanical support, Electrical Interface, Protection from the environment and Thermal considerations. Types of MEMS packages-Flip-Chip assembly-Multichip module packaging: Wafer bonding-RF MEMS packaging and its reliability.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Vijay K. Varadan, K.J. Vinoy and K.A.Jose, RF MEMS & their Applications, John Wiley & Sons, 2011.

REFERENCES :

1. Gabriel M. Rebeiz, RF MEMS: Theory, Design, and Technology, John Wiley & Sons, 2004.
2. Tai-Ran Hsu, MEMS and Microsystems: Design and Manufacture McGraw-Hill, 1st Edition, ISBN: 0072393912. , 2002.

17ECX06 - COMPUTER HARDWARE INTERFACING				
L	T	P	C	
3	0	0	3	
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To introduce issues related to BIOS.	**1.1**	The students will be able to Design the BIOS.	**a,b,c**
2.0	To study the concept of CPU.	**2.1**	The students will be able to Analyze the working of CPU.	**e,g,h**
3.0	To understand different storage media.	**3.1**	The students will be able to Understand storage concepts.	**a,c,d**
4.0	To learn the features of different memory.	**4.1**	The students will be able to Understanding the functioning of memory.	**b,d,f**
5.0	To make the students to learn the various peripherals	**5.1**	The students will be able to Learning various peripherals.	**b,c,d**

UNITI - BIOS AND BUS ARCHITECTURES	**(9)**
BIOS features – BIOS and Boot sequences – BIOS shortcomings and compatibility issues - Industry standard architecture (ISA), peripheral component Interconnect (PCI) – Accelerated Graphics port (AGP) – General BUS troubleshooting.	
UNIT II - CENTRAL PROCESSING UNIT	**(9)**
CPU essentials – modern CPU concepts – Architectural performance features – the Intel's CPU – CPU over Clocking – over clocking requirements – over clocking the system – over clocking the Intel processors.	
UNIT III - STORAGE DEVICES	**(9)**
The floppy drive – magnetic storage – hard drive – sector layout – IDE drive standard and features – Drive Preparation concepts – partitioning – formatting – FAT basics-USB.	
UNIT IV - MEMORY	**(9)**
Essential memory concepts-Memory organizations – memory packages – modules – logical memory organizations – memory considerations – memory types – memory techniques – selecting and installing memory .	
UNIT V - MOTHERBOARS & I/O PHERIPHERALS	**(9)**
Active motherboards – sockets and slots – expansion slots – form factor – upgrading a mother board – Parallel port – signals– IEEE1284 modes – asynchronous communication – serial port signals – graphic accelerators – 3D graphics accelerator issues.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Stephen J.Bigelow, Trouble Shooting, maintaining and Repairing PCs, Tata McGraw-Hill, NewDelhi Reprint 2014.

REFERENCES :

1. B.Govindarajulu, ―IBM PC and Clones hardware trouble shooting and maintenance, Tata McGraw-Hill, New Delhi, 2011.
2. Mike Meyers, Introduction to PC Hardware and Troubleshooting, Tata McGraw-Hill, New Delhi, 2003.

17ECX07 - CONTROL SYSTEMS ENGINEERING				
L	T	P	C	
3	0	0	3	
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To acquire a clear exposition of the classical methods of control engineering	**1.1**	The students can Calculate the transfer function of a system.	**a,d,i**
2.0	To obtain a clear elucidation of basic principles of time domain design techniques	**2.1**	The students will be able to determine the stability of linear systems	**b,d,e**
3.0	To obtain a clear elucidation of basic principles of frequency domain design techniques	**3.1**	The students will be able to analyze the frequency response components.	**a,c,g**
4.0	To learn the practical control system design with realistic system specifications.	**4.1**	The students will be able to analyze the stability and various frequency analysis techniques .	**a,d,i**
5.0	To provide knowledge of state variable models and state feedback design.	**5.1**	The Students can Formulate state-space models.	**b,d,e**

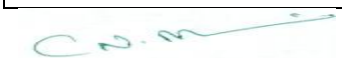
UNIT I - SYSTEMS AND THEIR REPRESENTATIONS	**(9)**
Mathematical Model of Control system, open loop & closed loop Control System, Transfer function concept – Mechanical Rotational systems, Mechanical Translational Systems, Block diagram reduction and signal flow graphs.	
UNIT II - TIME RESPONSE ANALYSIS	**(9)**
Time response – Time domain specifications – Types of test inputs, First order System and Second order system: Step Response of Second Order Under damped System – Steady state error, Static error constants.	
UNIT III - FREQUENCY RESPONSE ANALYSIS AND DESIGN	**(9)**
Frequency response, frequency domain specifications, Bode plots – Polar Plots, Gain Margin and phase Margin Assessment, Correlation between frequency domain and time.	
UNIT IV - STABILITY ANALYSIS AND COMPENSATION	**(9)**
Stability - Concept and definition - Bounded Input Bounded output stability, Location of poles – Routh Hurwitz criterion, Root locus techniques, Gain and Phase Margin, Nyquist Stability Criterion.	
UNIT V- STATE-SPACE ANALYSIS	**(9)**
Introduction to state space analysis – Concepts of state variables & model, State models for Linear CT Systems, Solutions of state equations.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. I.J. Nagrath and M.Gopal, "Control Systems Engineering", New Age International, 5th Edition, 2008.

REFERENCES:

1. Smarajit Ghosh, "Control System (Theory and Applications)", Pearson Education, 2005.
2. A.Nagoor Kani, "Control Systems", RBS Publications-2nd Edition. 2002.
3. K. Ogata, "Modern Control Engineering", Pearson 4th Edition. 2005.
4. I. J Norman S. Nise, "Control System Engineering", John Wiley & Sons, 4th Edition, 2004.



17ECX08 - DIGITAL IMAGE PROCESSING				
L	T	P	C
3	0	0	3

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE - 1**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To study the image fundamentals necessary for image processing	**1.1**	The students will be able to know the image formation and the role human visual system plays in perception of Gray and color image data	**a,b,i,j,l**
2.0	To enable the student to Know about Image transforms and its properties	**2.1**	The students will be able to apply transform-domain representation of images	**a,b,c,f,j**
3.0	To study the concept of enhancement and restoration techniques.	**3.1**	The students will be able to perform image analysis by designing spatial and frequency domain filters.	**a,b,d,k,l**
4.0	To analyze image compression procedures.	**4.1**	The students will be able to describe how digital images are represented and stored efficiently depending on the desired quality	**a,b,c,d,k**
5.0	Gain experience in applying image processing algorithms to real problems	**5.1**	The students will be able to detect/extract regions of interest from an image using various thresholding and Segmentation Techniques	**a,b,i,j,l**

UNIT I - DIGITAL IMAGE FUNDAMENTALS	**(9)**
Elements of digital image processing systems - Elements of visual perception - brightness-contrast-hue-saturation-mach band effect - Image sampling-Quantization-Basic relationship between pixels - Color image fundamentals-RGB-HSI models.	
UNIT II -IMAGE TRANSFORMS	**(9)**
2D transforms-DFT-DCT-Discrete Sine, Walsh-Hadamard, Slant-Haar, KL transforms-properties of all transforms.	
UNIT III-IMAGE ENHANCEMENT AND RESTORATION	**(9)**
Spatial Domain enhancement: gray level transformations–histogram equalization-Image averaging-Spatial filtering: Smoothing, Sharpening filters- Frequency domain filters: Smoothing-Sharpening filters-Homomorphic filtering. Image Restoration: Degradation model-Unconstrained and Constrained restoration-Inverse filtering-Wiener filtering.	
UNIT IV -IMAGE COMPRESSION	**(9)**
Need for data compression-Error free compression-Variable length coding-Bit-Plane coding-Lossless and Lossy Predictive coding, JPEG and MPEG Compression Standards.	
UNIT V-IMAGE SEGMENTATION AND REPRESENTATION	**(9)**
Point- Line and edge detection- Thresholding – Region based segmentation: Region splitting and merging. Image representation: chain codes-polygonal approximations-signatures-boundary segments-skeletons.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Pearson Education, 3rd Edition, 2016.

REFERENCES :

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Tata McGraw Hill Pvt. Ltd., 3rd Edition, 2011.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., Second Edition, 2004.
3. William K Pratt, “Digital Image Processing”, Willey India Pvt Ltd., Fourth Edition, 2010.

17ECX09- WIRELESS COMMUNICATION				
L	T	P	C
3	0	0	3
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE - 1**		

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To deal with the fundamental cellular radio concepts and the technical challenges	**1.1**	The student will be able to Interpret the fundamental cellular radio concepts, Multipath propagation, Spectrum Limitations, Noise and Interference limited systems	**a,b,e**
2.0	To present different ways to radio propagation models and predict the large – scale and small scale effects of radio propagation in many operating environment.	**2.1**	The students will be able to understand radio propagation models and predict the large scale and small scale effects	**a,c,f,l**
3.0	To provide idea about analog and digital modulation techniques used in wireless communication.	**3.1**	The students will be able to Compute deduce Modulation and demodulation technique	**a,b,c,e,f,l**
4.0	To deal with the different types of equalization techniques and diversity concepts.	**4.1**	The students will be able signal processing in wireless system.	**a,c,e,f**
5.0	It deals with advanced transceiver schemes.	**5.1**	The students will be able to figure out the different Spread Spectrum Systems	**a,e,f,l**

UNIT I - WIRELESS SERVICES AND TECHNICAL CHALLENGES	**(9)**
Types of Services, Requirements for the services, Multipath propagation, Spectrum Limitations, Noise and Interference limited systems, Principles of Cellular networks, Multiple Access Schemes.	
UNIT II - WIRELESS PROPAGATION CHANNELS	**(9)**
Propagation Mechanisms – Reflection, Diffraction, reflection. Link calculations, Statistical description of the wireless channel- Time variant and Invariant Two path model, Rayleigh distribution. Small scale fading with a dominant component, Large scale fading. Narrowband and Wideband models.	
UNIT III - WIRELESS TRANSCEIVERS	**(9)**
Structure of a wireless communication link, Important Modulation formats – Binary Phase shift keying, Quadrature Phase Shift Keying, p/4-Differential Quadrature Phase Shift Keying, Offset-Quadrature Phase Shift Keying, Binary Frequency Shift Keying, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error probability in flat fading channel.	
UNIT IV - SIGNAL PROCESSING IN WIRELESS SYSTEMS	**(9)**
Principle of Diversity, Macrodiversity, Microdiversity, Combination of signals, Transmit diversity, Channel coding – Block coding, convolution coding and trellis codes.	
UNIT V - ADVANCED TRANSCEIVER SCHEMES	**(9)**
Spread Spectrum Systems- Frequency hopping multiple access, Code division multiple access, Cellular Code Division Multiple Access Systems- Principle, Power control, Orthogonal Frequency Division Multiplexing – Principle, Frequency selective channel, Inter carrier interference. Implementation of Second Generation (GSM, IS–95) and 3G and 4G - VoLTE Wireless Networks and Standards.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Andreas.F. Molisch, “Wireless Communications”, John Wiley – India, Second Edition 2006.

REFERENCES:

1. Rappaport. T.S., “Wireless communications”, Pearson Education, 2003.
2. Gordon L. Stuber, “Principles of Mobile Communication”, Springer International Ltd., 2001.
3. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2007.

17ECX10 - HIGH SPEED NETWORKS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To acquire the knowledge about Asynchronous Transfer Protocol	**1.1**	The Students will be able to distinguish the various latest networks.	**d,e,j**
2.0	To analyze the different extents of quality of service to different applications.	**2.1**	The Students will be able to evaluate the different queuing model.	**c,e,h**
3.0	To learn various algorithms in TCP and ATM congestion control.	**3.1**	The Students will be having the capability to analyze various congestion control mechanisms.	**d,i**
4.0	To understand integrated and differentiated service.	**4.1**	The students will be able to analyze integrated and differentiated services.	**f,i**
5.0	To analyze multiprotocol label switching network.	**5.1**	The students will be able to identify the intricacies of RSVP, MPLS and RTP protocols.	**g,l**

UNIT I HIGH SPEED NETWORKS	**(9)**
Frame Relay Networks – Asynchronous transfer mode: ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories, AAL, High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements, Architecture of 802.11.	
UNIT II - CONGESTION AND TRAFFIC MANAGEMENT	**(9)**
Queuing Analysis: Queuing Models, Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.	
UNIT III- TCP AND ATM CONGESTION CONTROL	**(9)**
TCP Flow control – TCP Congestion Control: Retransmission Timer Management, Exponential RTO backoff, KARN's Algorithm, Window management – Performance of TCP over ATM -Traffic and Congestion control in ATM – Requirements, Attributes, Traffic Management Frame work, Traffic Control.	
UNIT IV - INTEGRATED AND DIFFERENTIATED SERVICES	**(9)**
Integrated Services Architecture: Approach, Components, Services- Queuing Discipline: FQ, PS, BRFQ, GPS, WFQ – Random Early Detection - Differentiated Services	
UNIT V- PROTOCOLS FOR QOS SUPPORT	**(9)**
RSVP: Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching: Operations, Label Stacking – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOK:

1. William Stallings, "HIGH SPEED NETWORKS AND INTERNET", Pearson Education, Second Edition, 2010.

REFERENCES :

1. Warland, Pravin Varaiya, "High performance communication networks", Second Edition, Jean Harcourt Asia Pvt. Ltd., 2001.
2. Irvan Pepelnjk, Jim Guichard, Jeff Apcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003.
3. Abhijit S. Pandya, Ercan Sea, "ATM Technology for Broad Band Telecommunication Networks", CRC Press, New York, 2004.

17ECX11 - MODERN MICROPROCESSORS AND MICROCONTROLLERS			
L	T	P	C
3	0	0	3

PREREQUISITE : NIL	QUESTION PATTERN : TYPE - 1

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To expose the students to the fundamentals of microprocessor architecture.	**1.1**	The students will be able to acquire knowledge about memory hierarchy, Paging, Segmentation and Pipelining.	**a,b,e,l**
2.0	To introduce the advanced features in microprocessors and microcontrollers.	**2.1**	The students will be able to gain knowledge and design a system using Pentium Processor.	**c,f,l,k**
3.0	To Understand the concepts of high level language programming	**3.1**	The students will be able to develop programming and system design using Pentium Processor.	**c,e,f,k**
4.0	To enable the students to understand various microcontroller architectures.	**4.1**	The students will be able to build up programming and system design using Motorola Microcontroller.	**c,e,f,k**
5.0	Familiar with the concepts of RISC based Microcontroller architecture	**5.1**	The students will be able to gain programming and design knowledge in MSP 430 Microcontroller.	**c,e,f,k**

UNIT I – MICROPROCESSOR ARCHITECTURE	**(9)**
.Instruction Set – Data formats –Addressing modes – Memory hierarchy –register file –Cache – Virtual memory and paging – Segmentation- pipelining –the instruction pipeline– pipeline hazards – instruction level parallelism – reduced instruction set –Computer principles – RISC versus CISC	
UNIT II – HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM	**(9)**
CPU Architecture- Bus Operations – Pipelining – Brach predication – floating point unit-Operating Modes –Paging – Segmentation – Multitasking.	
UNIT III - PENTIUM- PROGRAMMING AND ADVANCED PROCESSORS	**(9)**
Exception - Interrupts – Instruction set –addressing modes – Programming the Pentium processor-Advanced Pentium processors: Intel Core 5 and Core i7.	
UNIT IV - MOTOROLA 68HC11 MICROCONTROLLERS	**(9)**
Instruction set addressing modes – operating modes- Interrupt system- RTC-Serial Communication Interface – A/D Converter PWM and UART.	
UNIT V- MSP430 MICROCONTROLLER	**(9)**
Architecture of the MSP430: Central Processing unit-Addressing modes –Constant generator and emulated instruction –Instruction Set–Resets–Clock System Function and subroutine–Interrupts–Low Power modes of Operation –Watch dog timer -Serial peripheral Interface.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Daniel Tabak , „‟ Advanced Microprocessors" McGraw Hill.Inc., 1995 (For Unit I Only)
2. James L. Antonakos , " The Pentium Microprocessor „‟ Pearson Education , 1997. (For Unit II & III Only)
3. Gene .H.Miller ." Micro Computer Engineering," Pearson Education, 2004. (For Unit IV Only)
4. John davies " MSP430 MICROCONTROLLER basics"Elsevier,2008. (For Unit V Only)

REFERENCES :

1. James L.Antonakos ," An Introduction to the Intel family of Microprocessors „‟ Pearson Education 1999.
2. Barry.B.Breg," The Intel Microprocessors Architecture, Programming and Interfacing ", PHI, 2009.
3. https://en.wikipedia.org/wiki/Intel_Core_2
4. http://www.expertreviews.co.uk/pcs/cpus/1400962/whats-the-difference-between-core-i3-i5-and-i7- processors.

17ECX12- PROTOCOLS AND ARCHITECTURES FOR WIRELESS SENSOR NETWORKS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE - 1**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to learn the enabling Technologies for Wireless Sensor Networks.	**1.1**	The Students can apply their knowledge in the sensor network applications.	**b,c**
2.0	To enable the student to understand the network architecture	**2.1**	The Students will be able to analyse about the energy efficient network design.	**b,c,e,k,l**
3.0	To enable the student to understand Design Considerations of WSN	**3.1**	The Students will be able to design sensor network	**d,e,l**
4.0	To motivate the students to know the infrastructure establishment	**4.1**	The students will be able to analyse the Time Synchronization, Localization and Positioning, Sensor Tasking and Control of sensors.	**a,i,k**
5.0	To make the students to understand the different routing protocols.	**5.1**	The students will be able to routing protocol secured network design	**c,l**

UNIT I - OVERVIEW OF WIRELESS SENSOR NETWORKS	**(9)**
Introduction to wireless sensor network- Sensor network applications, Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks.	
UNIT II - ARCHITECTURES	**(9)**
Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Service interfaces of WSNs.	
UNIT III- NETWORKING SENSORS	**(9)**
Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , Assignment of MAC Addresses.	
UNIT IV - INFRASTRUCTURE ESTABLISHMENT	**(9)**
Topology Control- Controlling topology in flat networks, Hierarchical networks by dominating sets, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.	
UNIT V- ROUTING PROTOCOL	**(9)**
Introduction to routing protocol, Broadcast and multicast, Geographic routing, Mobile nodes, Energy efficient unicast, Advanced application support- Network processing, WSN security.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Holger Karl & Andreas Willig, “Protocols And Architectures for Wireless Sensor Networks” , John Wiley, 2012.

REFERENCES :

1. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach”, Elsevier, 2007.
2. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks- Technology, Protocols, And Applications”, John Wiley, 2007.
3. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

17ECX13 - TELECOMMUNICATION SWITCHING AND NETWORKS			
L	T	P	C
3	0	0	3

PREREQUISITE : NIL | **QUESTION PAPER TYPE : 1**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to learn the different multiplexing methods and SONET optical standards.	**1.1**	The Students can learn the different multiplexing methods and SONET optical standards.	**a,b,c,d,g,j,l**
2.0	To enable the student to identify digital multiplexing and digital switching.	**2.1**	The Students will be able to identify digital multiplexing and digital switching.	**a,c,e,f,g,i,l**
3.0	To enable the student to recognize the need for network synchronization issues and management.	**3.1**	The Students will be able to recognize the need for network synchronization issues and management.	**a,d,g,i,j,k,l**
4.0	To motivate the students to learn the local loop systems in digital environment.	**4.1**	The students will be able to learn the local loop systems in digital environment.	**a,b,c,d,g,j,l**
5.0	To make the students to acquire the knowledge about telephone traffic and statistical modeling.	**5.1**	The students can acquire the knowledge about telephone traffic and statistical modeling.	**a,b,c,g,i,l**

UNIT I - BACKGROUND AND TERMINOLOGY	**(9)**
The analog network hierarchy: Transmission Systems –FDM Multiplexing and Modulation-The introduction of Digits: Time Division Multiplexing-Digital transmission and multiplexing: Line coding-Bipolar coding-Binary N-Zero substitution-Ternary coding-Differential encoding-Fiber optic transmission systems: SONET/SDH- SONET Multiplexing Overview-SONET Frame Formats- SONET Operations-Administration and Maintenance- SONET Optical Standards- SONET Networks- SONET Rings.	
UNIT II - DIGITAL SWITCHING	**(9)**
Switching Functions- Space Division Switching- Time Division Switching - Two dimensional Switching: STS Switching- TST Switching- No.4 ESS Toll Switch- Digital Cross-Connect Systems- Digital Switching in an Analog Environment.	
UNIT III- NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT	**(9)**
Timing: Timing Recovery: Phase-Locked Loop-Clock Instability- Jitter Measurements- Systematic Jitter- Timing Inaccuracies: Slips- Asynchronous Multiplexing- Network Synchronization- U.S. Network Synchronization- Network Control- Network Management.	
UNIT IV - DIGITAL SUBSCRIBER ACCESS	**(9)**
Integrated services digital network: ISDN Basic Rate Access Architecture- High-Data-Rate Digital Subscriber Loops-Digital Loop Carrier Systems -Fiber in the Loop-Hybrid Fiber Coax Systems-Voice band Modems - Local Microwave Distribution Service- Digital Satellite Services.	
UNIT V- TRAFFIC ANALYSIS	**(9)**
Traffic Characterization - Loss Systems- Network Blocking Probabilities -Delay Systems: Exponential service Times-Constant Service Times- Finite Queues.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. John.C. Bellamy, “Digital Telephony”, John Wiley, 2003, 3rd Edition, Reprint 2011.

REFERENCES :

1. J.E. Flood, “Telecommunications Switching, Traffic and Networks”, Pearson Publication, Fourth impression 2008.
2. R.A.Thomson, “Telephone switching Systems”, Artech House Publishers, 2000.
3. Viswanathan. T., “Telecommunication Switching System and Networks”, Prentice Hall of India Ltd., 1994.

17ECX14 - MULTIMEDIA COMPRESSION TECHNIQUES			
L	T	P	C
3	0	0	3

PREREQUISITE : Nil | **QUESTION PATTERN : TYPE - 1**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to learn and understand the basics of information and coding.	**1.1**	The students will be able to understand the concept of information theory, models and coding.	**a,b,e,f,l**
2.0	To enable the student to Evaluate the text compression techniques	**2.1**	The students can acquire the knowledge of text compression coding techniques.	**a,b,c,f,l**
3.0	To enable the student to Evaluate the audio compression techniques	**3.1**	The students can able to study the audio compression coding and speech compression techniques.	**a,f,g**
4.0	To motivate the students to implement coding and compression approaches.	**4.1**	The students will be able to know the image compression approaches, coding and JPEG standards.	**b,g,l**
5.0	To make the students to learn wavelet based video compression.	**5.1**	The students will be Identify the wavelet based video compression.	**a,b,f**

UNIT I - INTRODUCTION	**(9)**
Overview of Information theory-models and coding- rate distortion theory-scalar quantization-vector quantization-structured vector quantizers.	
UNIT II - TEXT COMPRESSION	**(9)**
Compaction techniques - Static Huffman coding - Dynamic Huffman coding - Arithmetic coding - Lempel-Ziv coding - Lempel-Ziv Welsh coding.	
UNIT III - AUDIO AND SPEECH COMPRESSION	**(9)**
Audio compression techniques – frequency domain and filtering - Basic sub band coding - Application to speech coding - G.722 - Application of audio coding: MPEG audio - Silence compression – Speech compression techniques - Vocoders - Linear predictive coder.	
UNIT IV - IMAGE COMPRESSION	**(9)**
Approaches to image compression - Predictive techniques - PCM, DPCM, Graphics Interchange Format, Tagged image file format, Digitized documents, Digitized pictures, JPEG, Quad tree DCT coding-EZW coding- SPIHT coding- JPEG 2000 standards.	
UNIT V- VIDEO COMPRESSION	**(9)**
Video signal representation - Video compression techniques - MPEG1, 2, 4 - Motion estimation - H.261, H.263, and H.264 - Overview of wavelet based compression- Real time compression.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Sayood Khaleed, "Introduction to Data Compression", Morgan Kauffman, 4th Edition, Morgan Kaufmann publishers 2014.
2. Fred Halsall, James F. Kurose, "Multimedia communication - Applications, Networks, Protocols and standards", Pearson Education Limited, 2004

REFERENCES :

1. David Solomon, "Data Compression the complete reference", Springer, 4th Edition, 2007.
2. Jerry D. Gibson, "Multimedia Communications: Directions and Innovations", Morgan Kaufmann, 2nd Edition, 2001.

17ECX15 - SATELLITE COMMUNICATION					
		L	T	P	C
		3	0	0	3
PREREQUISITE : Nil	**QUESTION PATTERN : TYPE - 1**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To know the elements of satellite communication and orbits	**1.1**	The students will be able to learn the different satellite orbits and launching procedures	**a,b,c,j**
2.0	To provide knowledge space segment and link of the satellite	**2.1**	The students will be able to design & Analysis of various parameters in space segments	**a,d,f**
3.0	To provide knowledge on earth segment of the satellite	**3.1**	The students will be able to design & Analysis of various parameters in earth segments	**c,d,j,k**
4.0	To provide the basic concepts of Accessibility of satellite	**4.1**	The students will be able to know the satellite communication system and access	**a,e,f,i**
5.0	An exposure the knowledge about Satellite communication	**5.1**	The students will be able to understand the satellite communication system and its applications	**b,g,l**

UNIT I - SATELLITE ORBITS	**(9)**
Orbits and launching methods-sub satellite point-geo stationary and non Geo-stationary orbits: Look Angle Determination-Limits of visibility –Earth eclipse of satellite-Sub satellite point –Sun transit outage, Launching Procedures.	
UNIT II -SPACE CRAFT AND SATELLITE LINK DESIGN	**(9)**
Spacecraft Technology: Structure, Primary power, Attitude and Orbit control, station keeping, Thermal control, Telemetry, Tracking and command (TTC)-Link design: Satellite uplink and downlink-Analysis and Design, link power budget equations-system noise-inter modulation noise.	
UNIT III- EARTH SEGMENT	**(9)**
Introduction-Receive only home TV systems- MATV-CATV-Transmit receive earth stations- Interference between satellite circuits: Downlink-uplink-C/N ratio, Antenna gain function.	
UNIT IV - SATELLITE ACCESS	**(9)**
Introduction-pre assigned and demand assigned FDMA-TDMA-CDMA-spread spectrum modulation-ATM.	
UNIT V-SATELLITE APPLICATIONS	**(9)**
INTELSAT –VSAT-Mobile satellite services: GSM, GPS-Satellite Navigational System-Direct Broadcast satellites (DBS)-Direct to home Broadcast (DTH)- HDTV.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Dennis Roddy, “Satellite Communication”, McGraw Hill International, 4th Edition, 2006.

REFERENCES :

1. M.Richharia, “Satellite Communication Systems Design Principles”, Macmillan, 2nd Edition, 2003.
2. Bruce R. Elbert, “The Satellite Communication Applications-Hand Book”, Artech HouseBostan London, 2nd Edition, 1997.
3. Brian Ackroyd, “World Satellite Communication and earth station Design”, BSP professional Books, 2nd Edition, 1990.

17ECX16 – INTERNET OF THINGS AND ITS APPLICATIONS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make the students to know about basics of Electrical and Electronic devices	**1.1**	The students will be able to understand basics of Electrical circuits and Electronic devices	**a,c,d,i**
2.0	To make the students to know about basics and block diagram of IoT	**2.1**	The students will be able to understand IOT characteristics and its essential components.	**a,b,d,e**
3.0	To make the students to know about Arduino processor and working of Analog and Digital I/O pins	**3.1**	The students will be able to describe Arduino processor and working of Analog and Digital I/O pins	**a,b,c,g**
4.0	To make the students to know about Raspberry pi and its interface with other devices	**4.1**	The students will be able to understand Raspberry pi and its interface with other devices	**a,b,c,j**
5.0	To motivate the students to implement the IoT using Arduino/ Raspberry Pi.	**5.1**	The students will be able to implement a IoT system using Arduino/Raspberry Pi.	**a,f,k,l**

UNIT I - BASIC ELECTRICAL CIRCUITS AND ELECTRONICS	**(9)**
Introduction - Current, voltage and resistance - Analog and Digital Signal - conductors Vs Insulators – KCL- KVL - Basic Electronics components - calculating equivalent resistance for series and parallel circuits- Ohm's law- Color coding for a resistor – LED – LCD - LDR.	
UNIT II - INTRODUCTION TO INTERNET OF THINGS	**(9)**
Introduction - Definition and characteristics of Internet of Things - General Block Diagram and essential components of IOT - Role of microprocessor & Micro controller- communication of things - IOT connection with internet.	
UNIT III- ARDUINO PROCESSOR	**(9)**
Introduction to Arduino processor- General Block diagram- Working of Analog and Digital I/O pins- Serial (UART) , I2C Communications and SPI communication - Arduino Boards: Mega, Due, Zero and 101 - Prototyping basics - Technical description - Setting Up Arduino IDE- Introduction to Arduino programming.	
UNIT IV - RASPBERRY PI	**(9)**
Technical Description of Raspberry Pi - comparison of Raspberry Pi Vs Arduino - Operating Systems for RPi - Preparing SD Card for Pi - Connecting Raspberry Pi as PC - Exploring Raspberry Pi Environment- Logical design using Python.	
UNIT V- APPLICATIONS OF IOT	**(9)**
Various Real time applications of IoT- automation - Smart Parking - Environment: Weather monitoring system - Agriculture: Smart irrigation – Domain Specific applications.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015.

REFERENCES :

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering",Tata McGraw Hill, Second Edition, (2006).
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key applications and Protocols", Wiley Publications 2nd edition, 2013.
3. Marco Schwartz, — Internet of Things with the Arduino Yun, Packt Publishing, 2014.
4. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley Publications, 2012.

17ECX17 – SPEECH PROCESSING			
L	T	P	C
3	0	0	3

PREREQUISITE : Nil | **QUESTION PATTERN : TYPE - 1**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To introduce speech production and related parameters of speech.	**1.1**	The students will be able to Model speech production system and describe the fundamentals of speech.	**a,b,d,e**
2.0	To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients in the analysis of speech.	**2.1**	The students will be able to Extract and compare different speech parameters.	**a,b,c,d,j**
3.0	To understand different speech modeling procedures such as Markov and their implementation issues.	**3.1**	The students will be able to Choose an appropriate statistical speech model for a given application.	**a,c,e,**
4.0	To understand different speech recognition procedures.	**4.1**	The students will be able to Design a speech recognition system.	**a,b,c,d,e**
5.0	To understand different speech synthesis procedures such as Markov and their implementation issues.	**5.1**	The students will be able toUse different speech synthesis techniques.	**a,b,c,e,f**

UNIT I - BASIC CONCEPTS **(9)**

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

UNIT II -SPEECH ANALYSIS **(9)**

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

UNIT III- SPEECH MODELING **(9)**

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

UNIT IV - SPEECH RECOGNITION **(9)**

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.

UNIT V- SPEECH SYNTHESIS **(9)**

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status

TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Lawrence Rabiner and Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education, 2003.
2. Daniel Jurafsky and James H Martin, “Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson Education, 2002.

REFERENCES :

1. Steven W. Smith, “The Scientist and Engineer‟s Guide to Digital Signal Processing”, California Technical Publishing, 1997.
2. Thomas F Quatieri, “Discrete-Time Speech Signal Processing – Principles and Practice”, Pearson Education, 2004.

17ECX18 – OPTO ELECTRNIC DEVICES				
	L	T	P	C
	3	0	0	3
PREREQUISITE : Nil	**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make the students to understand the basics of solid state physics.	**1.1**	The students will be able to learned solid state physics.	**a,b,d,e**
2.0	To make the students to understand the basics of display devices.	**2.1**	The students will be able to design display devices	**a,b,c,d,j**
3.0	To make the students to understand the optical detection devices.	**3.1**	The students will be able to design optical detection devices.	**a,c,e,**
4.0	To motivate the students to understand the design of optoelectronic Modulator.	**4.1**	The students will be able to design optoelectronic Modulator..	**a,b,c,d,e**
5.0	To motivate the students to understand the design of optoelectronic integrated circuits.	**5.1**	The students will be able to design optoelectronic integrated circuits.	**a,b,c,e,f**

UNIT I - ELEMENTS OF LIGHT AND SOLID STATE PHYSICS	**(9)**
Wave nature of light, Polarization, Interference, Diffraction, Light Source, review of Quantum Mechanical concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.	
UNIT II -DISPLAY DEVICES AND LASERS	**(9)**
Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of Lasers,Mode Locking, laser applications.	
UNIT III- OPTICAL DETECTION DEVICES	**(9)**
Photo detector, Thermal detector, Photo Devices, Photo Conductors, Photo diodes ,Detector Performance.	
UNIT IV - OPTOELECTRONIC MODULATOR	**(9)**
Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acoustoptic devices, Optical, Switching and Logic Devices.	
UNIT V- OPTOELECTRONIC INTEGRATED CIRCUITS	**(9)**
Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Pallab Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., New Delhi, 2006.
2. Jasprit Singh, “Opto Electronics – As Introduction to Materials and Devices”, Mc Graw-Hill International Edition, 1998

REFERENCES :

1. S.C Gupta, Opto Electronic Devices and Systems, Prentice Hal of India, 2005.
2. J. Wilson and J.Haukes, “Opto Electronics – An Introduction”, Prentice Hall, 1995

17ECX19 – CRYPTOGRAPHY AND NETWORK SECURITY			
L	T	P	C
3	0	0	3

PREREQUISITE : NIL	QUESTION PATTERN: TYPE - 1

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To acquire knowledge of various security defense methods and standards	**1.1**	The students will be able to know about various security defense methods and standards.	**a,b,c,f**
2.0	To provide knowledge of Symmetric Cryptography and its types	**2.1**	The students will be able to learn about Symmetric Cryptography and its types	**a,b,d,f**
3.0	To provide idea about Public Key Cryptography Algorithms	**3.1**	The students will be able to develop new Public Key Cryptography Algorithms.	**a,b,c,d,h**
4.0	To learn about Message Authentication algorithms like HASH function and HMAC	**4.1**	The students will be able to apply Message Authentication algorithms like HASH function and HMAC.	**a,b,c,i,j,l**
5.0	To acquire knowledge of Network and System Security methods	**5.1**	The students will have knowledge about Network and System Security methods	**a,b,d,i,j,l**

UNIT I – SECURITY IN COMPUTING	**(9)**
Security services- Attacks- Mechanism- Points of Security Vulnerability - Methods of Defense- Controls Effectiveness of Control- Introduction to Cryptography and Steganography- Plan of attack - Attack on Encryption – Standards: Standard Setting Organizations - IEC 62443, ISO 27001	
UNIT II – SYMMETRIC CRYPTOGRAPHY	**(9)**
Encryption and Decryption- Substitution- Transposition- Traditional Block Cipher Structure- Data Encryption Standard- Advance Encryption Standard- Triple DES, Stream Ciphers, RC4 Ciphers	
UNIT III – PUBLIC KEY CRYPTOGRAPHY	**(9)**
Introduction to Number Theory-Requirements of Public Key Cryptography - Rivest-Shamir-Adleman(RSA) algorithm - Key Management – Diffie - Hellman Key Exchange - Elliptic Curve Cryptography.	
UNIT IV – MESSAGE AUTHENTICATION	**(9)**
Hash functions –Secure Hash algorithm- Message Authentication Requirements, Functions - HMAC- Digital signatures- Elliptic Curve Digital Signature Algorithm**.**	
UNIT V – NETWORK AND SYSTEM SECURITY	**(9)**
Authentication applications - E-mail Security - IP security - Web security – Malicious Software - Intruders - Firewalls- Art cyber security- Defense in depth.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. William Stallings, "Cryptography & Network Security: Principles & Practices", 7th Edition, Pearson Education, New Delhi, 2017.

REFERENCES:

1. Behrouz A Forouson, "Cryptography & Network Security", Tata McGraw Hill, New Delhi, 2010.
2. Charles P Pleeger, "Security in Computing", Prentice Hall, New Delhi, 2011.
3. Paul C Van Oorschot and Scott A Vanstone, "Handbook of Applied Cryptography", CRC Press.

17ECX20 – STATISTICAL THEORY OF COMMUNICATION					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE - 1**			
COURSE OBJECTIVES AND OUTCOMES:					

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make the students to know about Random Process.	**1.1**	The students will be able to understand various operations in Random Process.	**a,c,d,i**
2.0	To make the students to know about different realizable linear systems and Matched filtering.	2.1	The students will be able to understand different realizable linear systems and Matched filtering.	**a,b,d,e**
3.0	To make the students to know about the Entropy function and Mutual information.	3.1	The students will be able to describe the Entropy function and Mutual information.	**a,b,c,g**
4.0	To make the students to know about different encoding techniques and their implementation.	4.1	The students will be able to understand different encoding techniques and their implementation.	**a,b,c,j**
5.0	To motivate the students to identify the required modulation according to the application.	5.1	The students will be able to identify the required modulation according to the application.	**a,f,k,l**

UNIT I – RANDOM PROCESS	**(9)**
Review of probability Theory -Random variables -Operations on single and multiple random variables-random process concept-stationarity -Ergodicity -First order markov process .	
UNIT II – OPTIMUM LINEAR SYSTEMS	**(9)**
I/O Relations of linear systems subjected to random inputs-Transmission of Gaussian process through linear system -Linear Mean Square filtering.	
UNIT III- CONCEPT OF INFORMATION THEORY	**(9)**
Memoryless Finite Schemes-Self information measure -Entropy function -Conditional Entropies -Characteristics of Entropy function -Derivation of the noise characteristics of a channel -Mutual information -Redundancy -Efficiency and channel capacity.	
UNIT IV – ELEMENTS OF ENCODING	**(9)**
Separable binary codes -Shannon -Fano encoding -Necessary and sufficient conditions for noiseless coding -Shannon‘s binary coding -fundamental theorem of discrete noise-less coding -Huffman's code -Gilbert Moore coding.	
UNIT V- CONTINUOUS CHANNELS	**(9)**
Definitions of different entropies -Mutual information -Maximization of the entropy of a continuous random variable -Entropy maximization problems -Channel capacity under the influence of additive white Gaussian Noise-Hartley Shannon's Law -Trade -off between Bandwidth and SNR.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

2. Reza F M, "An Introduction to information theory", McGraw Hill, New Delhi.2010.
3. Peebles P Z, "Probability, Random Variables and Random Signal Principles", McGraw Hill, New Delhi, 2002.

REFERENCES :

1. Thomas M Cover and Thomas J A, “Elements of InformationTheory”, John Wiley & Sons, Singapore, 2010.
2. Lathi B P, “Modern Digital and Analog Communication System", Oxford University Press, New York, 2010.
3. Simon Haykin, “Communication Systems”, John Wiley Higher Education, New Delhi, 2008.
4. Popoulis, “Probability, Random Variables & Stochastic Processes”, McGraw Hill International Editions, New Delhi, 2002.

17CSX01- DATA SCIENCE					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL	**QUESTION PATTERN: TYPE -1**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To understand the Lifecycle of data science projects.	**1.1**	The students will be able to understand the basics of data science and big data field.	**a,b,c,d,e,l**
2.0	To apply various techniques for mining data stream.	**2.1**	The students will be able to design efficient techniques for mining large volumes of data in engineering applications.	**a,b,c,d,e,l**
3.0	To analyze the data using classification techniques.	**3.1**	The students will be able to deploy the technique of classification and prediction in data science.	**a,b,c,d,e,l**
4.0	To understand the clustering and analysis methods.	**4.1**	The students will be able to understand about the clusters and analyze the big data for useful business applications.	**a,b,c,d,e,l**
5.0	To apply visualization techniques to clearly communicate analytic insights to business sponsors, analytic audiences and use tools like Hadoop, Giraph.	**5.1**	The students will be able to apply tools like Hadoop, Giraph and storm to implement real time applications.	**a,b,c,d,e,l**

UNIT I INTRODUCTION	**(9)**
Data Science – Related fields – Data Scientist – Roles - Data mining – limits on data mining - Big Data - Computing Environment - NoSQL Stores – Hadoop and Map Reduce Architecture - Life cycle of data science project.	
UNIT II DATA AND RELATIONS	**(9)**
Data scales - Set and Matrix Representations - Relations - Similarity Measures - Dissimilarity Measures - Sequence Relations - Sampling and Quantization.	
UNIT III CLASSIFICATION	**(9)**
Criteria, Naive Bayes Classifier, Linear Discriminant Analysis, Regression - Support Vector Machine, Nearest Neighbor Classifier, Decision Trees.	
UNIT IV CLUSTERING AND ANALYSIS	**(9)**
Cluster analysis - K-means - Hierarchical clustering - Time series analysis - Recommendation Systems - Text analysis.	
UNIT V DATA VISUALIZATION AND ENGINEERING	**(9)**
Diagrams, Principal Component Analysis- Multidimensional Scaling - Histograms - Spectral Analysis - MapReduce - Bulk Synchronous Parallel Distributed Computation - Event Processing - Case Studies: Hadoop, Giraph, Storm	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Thomas. A. Runkler 2012, “Data Analytics: Models and algorithms for Intelligent Data Analysis”, Springer, Germany.
2. Jared Dean 2014, “Big Data, Data Mining and Machine learning”, Wiley publications.

REFERENCES:

1. Anand Rajaraman and Jeffrey David Ullman, 2011, “Mining of Massive data sets”, Cambridge University press.
2. Donald Miner, Map Reduce Design Patterns: “Building Effective Algorithms and Analytics for Hadoop and Other Systems”, O'Reilly Media, 2012.

17CSX26 - HADOOP DISTRIBUTED ENVIRONMENT				
L	T	P	C	
3	0	0	3	
PRE REQUISITE : NIL	**QUESTION PATTERN: TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To know the fundamentals of big data analytics.	1.1	The students will be able to Identify the need for big data analytics for a domain.	**a,c,f,g,h,l**
2.0	To gain exposure about use cases in hadoop.	2.1	The students will be able to understand the use cases in hadoop.	**a,c,f,g,h,l**
3.0	To understand the Hadoop setup and HDFS Concepts.	3.1	The students will be able to initialize Hadoop and HDFS.	**a,c,e,f,g,h,l**
4.0	To use Map-Reduce programming model for processing large sets of data in parallel.	4.1	The students will be able to Design applications using Map Reducing Concepts.	**a,b,c,e,f,g,h,i,l**
5.0	To learn about Hadoop storage and deployment	5.1	The students will be able to know the storage and deployment concepts.	**a,c,e,f,g,h,l**

UNIT I - HADOOP	**(9)**
Introducing Hadoop and Seeing What It's Good For : Big Data and the Need for Hadoop – Exploding data volumes – Varying data structures – A playground for data scientists – The Origin and Design of Hadoop – Distributed processing with MapReduce – Apache Hadoop ecosystem – Examining the Various Hadoop Offerings – Comparing distributions – Working with in – database MapReduce – Looking at the Hadoop toolbox.	
UNIT II - COMMON USE CASES FOR BIG DATA IN HADOOP	**(9)**
The Keys to Successfully Adopting Hadoop – Log Data Analysis – Data Warehouse Modernization – Fraud Detection – Risk Modeling – Social Sentiment Analysis– Image Classification – Graph Analysis – To Infinity and Beyond	
UNIT III - SETTING UP YOUR HADOOP ENVIRONMENT	**(9)**
Choosing a Hadoop Distribution– Choosing a Hadoop Cluster Architecture– Setting up the Hadoop – Sample Data Set – First Hadoop Program: Hello Hadoop! How Hadoop Works: Storing Data in Hadoop – HDFS – Architecture – Keeping track of data blocks with NameNode – Checkpointing updates – HDFS Federation – High Availability – Reading and Writing Data – Compressing Data – Managing Files with the Hadoop File System Commands – Ingesting Log Data with Flume.	
UNIT IV - MAP REDUCE	**(9)**
MapReduce Programming: Thinking in Parallel – Importance of MapReduce – Looking at MapReduce application flow – key/value pairs fit into the MapReduce application flow – Writing MapReduce Applications – Running Map Reduce Application	
UNIT V - STORAGE AND DEPLOYMENT	**(9)**
Hadoop and the Data Warehouse: Comparing and Contrasting Hadoop with Relational Databases – NoSQL data stores – ACID versus BASE data stores – Structured data storage and processing in Hadoop – Modernizing the Warehouse with Hadoop – A queryable archive of cold warehouse data – Hadoop as a data preprocessing engine – Data discovery and sandboxes – Deploying Hadoop: Working with Hadoop Cluster Components – Hadoop Cluster Configurations – Alternate Deployment Form Factors – Sizing Your Hadoop Cluster	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Dirk deRoos, Paul C. Zikopoulos, Bruce Brown, Rafael Coss, and Roman B. MelnykA, "Hadoop For Dummies" 2014 by John Wiley & Sons, Inc., Hoboken, New Jersey.

REFERENCES:

1. Chris Eaton, Dirk Deroos et al., "Understanding Big Data: Analytics For Enterprise Class Hadoop And Streaming Data", The McGraw-Hill Companies, 2012.
2. Tom White, "Hadoop: The Definitive Guide ",O Reilly 2012.

17CSX31- PROBLEM SOLVING AND PROGRAMMING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17CSC01 / 17CSC02		**QUESTION PATTERN : TYPE 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To gain knowledge about the basics of programming	**1.1**	The students will be able to understand the basics of Python Programming constructs.	**a,c,l**
2.0	To gain exposure about selection structure	**2.1**	The students will be able to design programs involving selection structure	**a,b,c,d,l**
3.0	To get knowledge about repetition structure, function and modules	**3.1**	The students will be able to design programs involving function, modules and loops.	**a,b,c,d,k,l**
4.0	To gain exposure about string	**4.1**	The students will be able to realize the need of strings.	**a,b,c,d,k,l**
5.0	To get knowledge about mutable and Immutable types	**5.1**	The students will be able to realize the need of list, tuples and dictionary.	**a,b,c,d,k,l**

UNIT I - INTRODUCTION TO BASICS OF PROGRAMMING	**(9)**
Basics - Variables and Assignment - Basic Data Types- Comments - Operators - print() - Floats	
UNIT II - SELECTION STRUCTURE	**(9)**
Introduction to Selection Structure - if statements, else statements, nested elif statements, truthy and falsey values, Control Structure	
UNIT III - VALUE – REPETITION AND RETURNING STRUCTURE	**(9)**
Loops - while loops, for loops - Nested Loops - Functions - modules - variable scope	
UNIT IV - DATA AND STRING PROCESSING	**(9)**
Strings - Accessing the Strings - Traversing the Strings - Working with Strings - Formatting Strings	
UNIT V - MUTABLE AND IMMUTABLE TYPES AND METHODS	**(9)**
Introduction to lists, indexing and slicing of list, del and list methods, Tuples, Dictionary and its methods.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Dr. R. Nageswara Rao, ―Core Python Programming, Dreamtech Press, 2017 Edition.
2. Reema Thareja - Problem Solving and Programming – Python, Oxford University Press, 2nd Edition.

REFERENCES:

1. Wesley J. Chun, ―Core Python Programming, Pearson Education, 2nd edition, 2010.

17ITC12 - DATABASE SYSTEMS CONCEPTS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To understand the different issues involved in the design and implementation of a database system.	**1.1**	The students will be able to describe the role of Database Management System in an Organization.	**a,c,j,k**
2.0	To study the physical and logical database designs, database modeling.	**2.1**	The students will be able to study basic database concepts including the structure and operations of the relational data model.	**a,c,j,k**
3.0	To understand and use data manipulation language to query, update, and manage a database	**3.1**	The students will be able to construct simple and Moderately advanced database queries using SQL.	**a,b,c,j,k**
4.0	To develop an understanding of essential DBMS concepts.	**4.1**	The students will be able to apply logical database design principles includes E-R diagrams & Normalization.	**a,b,c,k**
5.0	To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.	**5.1**	The students will be able to explain various file organizing & Indexing structure.	**a,b,c,k**

UNIT I - INTRODUCTION	**(9)**
Introduction to database systems - Definition of DBMS - Advantages of dbms - Views of data - Levels of data abstraction - Data Models and types - Database architecture - Entity relationship model - ER diagram.	
UNIT II - RELATIONAL DATA MODEL	**(9)**
Relational database structure - Procedural and Non procedural languages - Relational algebra : operations - Relational Calculus : Tuple relational calculus - Domain Relational Calculus - Integrity Constraints - SQL Commands : DDL - DML - TCL.	
UNIT III - DATABASE DESIGN	**(9)**
Functional dependency: Full functional Dependency - Partial dependency - Transitive dependency - multi valued dependency - Decomposition - Normalization - Normal Forms: 1NF - 2NF - 3NF - BCNF - 4NF - 5NF.	
UNIT IV - TRANSACTIONAL PROCESSING	**(9)**
Transaction - Properties of transaction - Transaction state - Serialization : types - Need for Serialization - Two Phase Commit - Save Point - Concurrency - Advantages of concurrency - Concurrency control mechanism - Locking protocols	
UNIT V - MEMORY STRUCTURES AND FILE ORGANIZATION	**(9)**
Memory hierarchy - Disk storage - Raid levels - Indexing: types - Hashing techniques - Query Processing tool - Query Evaluation.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Sixth Edition, McGraw Hill, 2010.

REFERENCES:

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education/Addison Wesley, 2007.
2. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Third Edition, Pearson Education, 2007.

17ITX26- PROBLEM SOLVING AND ALGORITHMIC SKILLS					
			L	T	P	C
			3	0	0	3
PREREQUISITE: NIL		**QUESTION PATTERN : TYPE - 1**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes**			**Related Program Outcomes**
1.0	To impart fundamental concepts of OOP using python	**1.1**	The students will be able to understand the basics of object oriented concepts in python.		**a,c,l**
2.0	To gain exposure about inheritance and polymorphism	**2.1**	The students will be able to develop applications using inheritance and polymorphism		**a,b,c,d,e,k,l**
3.0	To understand the abstract data types and tree data structures	**3.1**	The students will be able to implement the ADTs and trees		**a,b,c,d,e,k,l**
4.0	To see how graphs and heaps can be used to solve a wide variety of problems	**4.1**	The students will be able to design graph abstract data type and heap		**a,b,c,d,e,k,l**
5.0	To understand the sorting techniques and shortest path algorithms.	**5.1**	The students will be able to implement the sorting techniques and shortest path algorithms.		**a,b,c,d,e,k,l**

UNIT I - MOTIVATION OF FUNDAMENTAL CONCEPT IN PROGRAMMING	**(9)**
Implementation of Classes and Objects in Python - Class Attributes and Instance Attributes - 'self ' parameter - Static Methods and Instance Methods - init() method	
UNIT II - ADVANCED FEATURES IN CONCEPT OF PROGRAMMING	**(9)**
Performing Abstraction and Encapsulation in Python - Single Inheritance - Multiple Inheritance - Multilevel Inheritance - Public, Protected and Private - Naming Conventions. Polymorphism- Overriding and the super() method - Diamond Shape Problem in Multiple Inheritance - Overloading an Operator - Implementing an Abstract Base Class (ABC)	
UNIT III - INTRODUCTION TO ALGORITHMIC THINKING AND PEAK FINDING	**(9)**
Array data structure - Linked List Data Structure and Its Implementation - Stacks and Queues - Binary Search Trees - Balanced Trees: AVL Trees and Red-Black Trees	
UNIT IV - MAPPING VALUES AND PRINCIPLE OF OPTIMALITY	**(9)**
Heaps - Heapsort Algorithm - Associative Arrays and Dictionaries - Ternary Search Trees as Associative Arrays - Basic Graph Algorithms - Breadth - First And Depth - First Search - Spanning Trees	
UNIT V - ANALYZING NUMBER OF EXCHANGES IN CRAZY-SORT	**(9)**
Shortest Path Algorithms, Dijkstra's Algorithm - Bellman-Ford Algorithm - Kruskal Algorithm - Sorting Algorithms- Bubble Sort, Selection Sort and Insertion Sort - Quicksort and Merge Sort, Non-Comparison Based Sorting Algorithms, Counting Sort and Radix Sort	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Dusty Phillips, Python 3 Object-oriented Programming, Packt Publishing, Second Edition.
2. Bradley N. Miller, David L. Ranum,- Problem Solving with Algorithms and Data Structures Using Python, Franklin, Beedle & Associates, 2011.

REFERENCES:

1. Mark Summerfield - Programming in Python 3, Pearson Education, 2nd Edition
2. Michael T. Goodrich, Irvine Roberto Tamassia, Michael H. Goldwasser, - Data Structures and Algorithms in Python‖, 2013 edition.

17GEA03 - TOTAL QUALITY MANAGEMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To acquire various concepts of quality management.	**1.1**	Students can acquire various concepts of quality management.	**b,c,f**
2.0	To implement various principles of quality management.	**2.1**	Students can implement various principles of quality management.	**b,c,f**
3.0	To impart quality using statistical process.	**3.1**	Students will be able to impart quality using statistical process.	**b,c,e**
4.0	To use the various tools to maintain quality.	**4.1**	Students can learn to use the various tools to maintain quality.	**b,c,e**
5.0	To implement the quality system for ISO certification.	**5.1**	Students can implement the quality system for ISO certification.	**b,c,f,h**

UNIT I – INTRODUCTION	**(9)**
Definitions-Basic approach –Gurus of TQM- TQM Framework -Defining Quality- Dimensions of quality- Benefits of TQM – Leadership: Leadership Concepts – The Deming philosophy - Quality council - Quality statements- Strategic planning- Customer satisfaction: Customer perception of quality- Using customer complaints- service quality- Customer retention.	
UNIT II - TQM PRINCIPLES	**(9)**
Employee involvement: Motivation- Empowerment- Teams- Recognition and Reward- Performance appraisal – Continuous process improvement: The Juran Trilogy – PDSA cycle- Kaizen – Six sigma - Supplier Partnership: Partnering, Supplier selection - Supplier Rating.	
UNIT III- TQM TOOLS AND TECHNIQUES- I	**(9)**
Bench marking - Reason to bench mark, process – Quality Function Development (QFD)- Failure mode and effect analysis – Stages of FMEA- Other types of FMEA-Management tools: Tree diagram- Matrix diagram- Process decision program chart-Activity network diagram.	
UNIT IV - TQM TOOLS AND TECHNIQUES- II	**(9)**
Statistical process control: Pareto diagram –Process flow diagram- Cause and effect diagram- Histogram-Charts – Variable control chart-Control chart for attributes-Scatter diagrams -Process Capability – Total productive maintenance: Learning the new philosophy-Training-Improvement needs.	
UNIT V- QUALITY MANAGEMENT SYSTEMS	**(9)**
Benefits of ISO registration-ISO 9000 series of standards–ISO 9001 Requirements- implementation, Documentation, Internal Audits – Environmental Management system- ISO 14000 series standards- Concepts of ISO 14001- Requirements of ISO 14001- Benefits of EMS.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint, 2011.

REFERENCES :

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th ed., First Indian Edition, Cengage Learning, 2012.
2. Subburaj Ramasamy , “Total Quality Management”, Tata McGrawHill, First reprint 2009.
3. Suganthi. L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

17GEA04 - PROFESSIONAL ETHICS AND HUMAN VALUES				
L	T	P	C	
3	0	0	3	
PREREQUISITE : NIL	**QUESTION PATTERN : TYPE - 1**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To understand the theory of engineering ethics.	**1.1**	Students know the concepts of ethics and values.	**f, h**
2.0	To enable the students to create an awareness on Engineering Ethics and Human Values.	**2.1**	Students acquire the knowledge of interpersonal and organizational issues in ethics	**f, h**
3.0	To instill Moral and Social Values and Loyalty.	**3.1**	Students will be able to Highlight the ethical issues related to engineering.	**f, h, i, l**
4.0	To appreciate the safety, responsibilities and rights of others.	**4.1**	Students can learn the concepts of engineer's responsibilities and their rights.	**f, h, i, l**
5.0	To understand the role of professional bodies	**5.1**	Students will be able to understand the role of global issues and professional bodies.	**f, h, i, l**

UNIT I - HUMAN VALUES	**(9)**
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality- Introduction to Yoga and meditation for professional excellence and stress management.	
UNIT II - ENGINEERING ETHICS	**(9)**
Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.	
UNIT III - ENGINEERING AS SOCIAL EXPERIMENTATION	**(9)**
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – The Challenger case study – Bhopal Gas Tragedy and Chernobyl case studies.	
UNIT IV - SAFETY, RESPONSIBILITIES AND RIGHTS	**(9)**
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.	
UNIT V - GLOBAL ISSUES	**(9)**
Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", 4th Edition , Tata Mc Graw Hill, New Delhi, 2014.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India Private Limited, New Delhi, 20012.

REFERENCES:

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2008.
4. Web sources: 1. www.onlineethics.org 2. www.nspe.org 3. www.globalethics.org 4. www.ethics.org.

17MYB12 - BASIC STATISTICS AND NUMERICAL ANALYSIS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE - 4**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	Understanding of statistical fundamentals to interpret data	**1.1**	Students will be able to use statistical tools to solve problems from different fields.	**f, h**
2.0	Find numerical approximations to the roots of an equation by Newton method, numerical solution to a system of linear equations by Gaussian Elimination and Gauss-Seidel.	**2.1**	The students would be acquainted with the basic concepts in numerical methods and their uses.	**f, h**
3.0	Find the Lagrange Interpolation Polynomial for any given set of points.	**3.1**	Students will be able to huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.	**f, h, i, l**
4.0	Apply several methods of numerical integration, including Romberg integration.	**4.1**	Students will be able to Explain the consequences of finite precision and the inherent limits of the numerical methods considered and by using differentiation and integration.	**f, h, i, l**
5.0	Find numerical solution of a differential equation by Euler's, Predictor Corrector and Runge- Kutta Methods	**5.1**	Students will be able to methods introduced in the solution of ordinary differential equations will be useful in attempting any engineering problem.	**f, h, i, l**

UNIT I - BASIC STATISTICS	**(9)**
Measures of central tendency-Arithmetic mean and its properties, weighted arithmetic mean, Geometric mean, Harmonic mean, Median, Mode.	
UNIT II - SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS	**(9)**
Solution of equation – Newton Raphson method – Solution of linear system by Gaussian elimination and Gauss – Jordon method – Iterative methods: Gauss-Seidel method.	
UNIT III - INTERPOLATION AND APPROXIMATION	**(9)**
Divided differences in unequal intervals – Lagrangian Polynomials — Newton's forward and backward difference formulas for equal intervals.	
UNIT IV - NUMERICAL DIFFERENTIATION AND INTEGRATION	**(9)**
Numerical Differentiation using interpolation formulae – Numerical integration by Trapezoidal and Simpson's 1/3 rule – Romberg's method – Two and Three point Gaussian quadrature formulae.	
UNIT V - INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS	**(9)**
Single step methods: Taylor series method – Euler's method for first order equation – Fourth order Runge – Kutta method for solving first order equations – Multistep methods: Milne's predictor and corrector methods.	

TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. S.C.Gupta and V. K. Kappor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons,11th ed.,2002.
2. T. Veerarajan. and T. Ramachandran., "Numerical Methods with programming in C", 2nd ed., Tata McGraw-Hill, 2006, First reprint 2007.
3. P. Kandasamy, K.Thilagavathy and K. Gunavathy, "Numerical Methods – Vol: IV", S.Chand & Co. Ltd. New Delhi, 2003, reprints 2007.

REFERENCES:

1. C.F Gerald and P.O Wheatley, "Applied Numerical Analysis", 7th ed., Pearson Education Asia, New Delhi 2007.
2. K. Sankar Rao, "Numerical Methods for Scientists and Engineers", 3rd ed., Prentice Hall of India, New Delhi, 2007,10th reprint 2012.
3. E. Balagurusamy, "Numerical Methods", Tata McGraw-Hill, New Delhi, 1999, 25threprint 2008.
4. M.K Venkatraman, "Numerical Methods" National Publication, New Delhi, 2000, reprint 2005.
5. B.S.Grewal,Numerical Methods in Engineering & Science ,Khanna publishers ,New Delhi,2012.

17ECX21 – COGNITIVE RADIO					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 1**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**			**Related Program Outcomes**
1.0	To know the basics of the software defined radio.	**1.1**	The students will be able to explain the principles of the software defined radio.		**a,b,c**
2.0	To learn the architecture and topology of software defined radio.	**2.1**	The students will be able to describe the architecture of software defined radio.		**a,b,f**
3.0	To understand the design of the wireless networks based on the cognitive radios	**3.1**	The students will be able design considerations of cognitive radio.		**b,c,d,g,h**
4.0	To learn the cognitive radio architecture.	**4.1**	The students will be able to Illustrate cognitive radio architecture.		**a,b,c,j,k,l**
5.0	To understand the concepts of wireless networks and next generation networks.	**5.1**	The students will be able to demonstrate knowledge of spectrum sensing and apply cross-layer design for cognitive radio.		**a,b,d,g,i,j,l**

UNIT I – INTRODUCTION TO SOFTWARE DEFINED RADIO	**(9)**
Definitions and potential benefits, software radio architecture evolution, technology tradeoffs and architecture implications.	
UNIT II – SDR ARCHITECTURE	**(9)**
Essential functions of the software radio, basic SDR, hardware architecture, Computational processing resources, software architecture, top level component interfaces, interface topologies among plug and play modules.	
UNIT III – INTRODUCTION TO COGNITIVE RADIOS	**(9)**
Marking radio self-aware, cognitive techniques – position awareness, environment awareness in cognitive radios, optimization of radio resources.	
UNIT IV – COGNITIVE RADIO ARCHITECTURE	**(9)**
Primary Cognitive Radio functions, Behaviors, Components, A–Priori Knowledge taxonomy, observe – phase data structures, Radio procedure knowledge encapsulation, components of orient, plan, decide phases, act phase knowledge representation, design rules.	
UNIT V – NEXT GENERATION WIRELESS NETWORKS	**(9)**
The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Joseph Mitola III, "Software Radio Architecture: Object-Oriented Approaches to Wireless System Engineering", John Wiley & Sons Ltd. 2000.
2. Markus Dillinger, Kambiz Madani, Nancy Alonistioti, "Software Defined Radio", John Wiley, 2003.
3. Bruce A. Fette , "Cognitive Radio Technology", Elsevier Science, 2009.

REFERENCES:

1. Qusay. H. Mahmoud, "Cognitive Networks : Towards Self Aware Network", John Wiley & Sons Ltd. 2007.
2. Joseph Mitola, "Cognitive Radio Architecture", John Wiley & Sons, 2006.
3. Simon Haykin, "Cognitive Radio: Brain –Empowered Wireless Communications", IEEE Journal on selected areas in communications, Feb 2005.

17ITX29 IT OPERATIONS				
L	T	P	C
3	0	0	3

PREREQUISITE : NIL	QUESTION PATTERN: TYPE – III

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To understand the basics of IT operations and differentiate IT Operation Management & IT Service Management.	**1.1**	The student will be able to identify the operation policies and procedures.	**a,b,c,d,g,l**
2.0	To learn policies and procedures to achieve a safe working environment in terms of health and safety regulations.	**2.1**	The student will be able to apply the Corporate Etiquettes and make the working environment safer.	**c,d,f,g,h,i,l**
3.0	To know the basic principles of an Organization in IT Operations.	**3.1**	The student will be able to recognize the Key Concepts of Service Management in IT - enabled services.	**a,b,c,d,g,i,l**
4.0	To learn the basics of information security in IT environments.	**4.1**	The student will be able to design IT infrastructure and security mechanism in networks.	**a,b,c,d,e,f,g,h,l**
5.0	To learn the basics of Microsoft 365 in IT Operations.	**5.1**	The student can Implement the policies in Microsoft 365.	**a,b,c,d,e,f,g,l**

UNIT I - IT OPERATIONS	**9**
IT Operation Definition - Roles & Responsibilities of IT Operations - IT Monitoring - IT operations Management - Responsibilities of IT operations Management. IT Service Management: IT Service Management Best Practices - The Service Life Cycle(Service Strategy - Service Design - Service Transition - Service Operation - Continual Service Improvement) Functions of IT Service Management (Incident Management, Event Management, Request fulfillment, Problem Management, Change Management, Availability Management - The Service Desk) - Escalation & Governance Management.	
UNIT II - HEALTHY SAFE AND SECURE WORKING ENVIRONMENT & ETIQUETTE	**9**
Health and Safety Essentials - Control and Management Systems - Facilities Management and Ergonomics - Managing Equipment - Managing Material. Etiquette: Professionalism in Relationships - First Impressions - Conducting Yourself in a Working Environment - Make Your Work Place Healthy - Dinning Etiquette - Elevator Etiquette - Cafeteria Etiquette - Meeting Etiquette - Telephone Etiquette - Dealing with Difficult People and Conflicting Situations.	
UNIT III - ITIL	**9**
Introduction –Understanding ITIL Guiding Principles in an Organization–Optimize and Automate – Four Dimensions of Service Management – Key Activities of the Service Value Chain	
UNIT IV - IT INFRASTRUCTURE & INFORMATION SECURITY	**9**
Definition - Components of IT Infrastructure (Hardware, Software, Network) - Types of IT infrastructure (Traditional, Cloud, Hyperconverged)- Risk, Response and Recovery: Risk Management and Information Security - The Risk Management Process - Business Continuity Management - Backing Up Data and Applications - Incident Handling - Recovery From a Disaster.	

UNIT V – AMS & Tools	9
Introduction – Support Models – Activities Type – Audits – Microsoft 365 – Domain Management – Licensing – Managing Teams – Meeting Policies – Messaging Policies	
TOTAL (L:45) : 45 PERIODS	

REFERENCE BOOKS:

1. IT Service Management Support for your ITSM Foundation exam by John Sansbury, Ernest Brewster, Aidan Lawes, Richard Griffiths.
2. Managing Health, Safety and Working Environment Revised Edition: Management Extra 1st Edition by Elearn
3. Everything About Corporate Etiquette by Vivek Bindra
4. AXELOS, "ITIL® Foundation ITIL 4 Edition", TSO, 2019
5. Fundamentals of Information Systems Security 3rd Edition by David Kim, Michael G. Solomon
6. https://docs.microsoft.com/en-us/learn/m365/

17ITX30 ADVANCED IT OPERATIONS				
L	T	P	C	
3	0	0	3	
PREREQUISITE : 17ITX29	**QUESTION PATTERN : TYPE - III**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To understand basic concepts of cloud platform & design intelligent Cloud Services and Applications.	**1.1**	The student will be able to Recognize the essentials of Cloud Computing.	**a,b,c,e,g,i,k,l**
2.0	To explore the concepts of Map Reduce Programming.	**2.1**	The student will be able to work with Big Data Platform and its Use cases	**a,b,c,d,e,f,i,k,l**
3.0	To introduce the basic concepts and techniques of Machine Learning, Deep Learning and Artificial Intelligence.	**3.1**	The student will be able to use ML and other AI technologies to automate the identification and Resolution of common IT issues.	**a,b,c,d,e,i,k**
4.0	To understand the key concepts of intelligent automation.	**4.1**	The student will be able to identify different types of Variables, control flow and data table automation.	**a,b,c,d,e,f,g,h,i, j,k,l**
5.0	To learn how to use ServiceNow to manage IT tasks at any organization.	**5.1**	The student will be able to do Site Reliability Engineering and to do simulation using SeriveNow.	**a,b,c,e,f,g**

UNIT I - CLOUD COMPUTING	**8**
Introduction – Characteristics of Cloud computing – Architecture – Types – Service Models – SaaS, IaaS, PaaS – Regions – Cloud Security.	
UNIT II - BIG DATA & DATA SCIENCE	**10**
Introduction – Data science and Challenges – HDFS & Hadoop – Structured and Unstructured data – Processing Big Data – Supervised & Unsupervised Learning – Text Analysis – Data visualization	
UNIT III - AI/ML & AIOps	**10**
Introduction – Structure of Intelligent Agents – Knowledge and Reasoning – Machine Learning – Deep Learning – Applications of AI – AIOps Technologies – AIOps Benefits – Implementation	
UNIT IV - ROBOTIC PROCESS AUTOMATION (RPA)	**8**
Introduction – Variables – Control flow – Data Tables and Excel Automation – UI Automation – Selectors – Email Automation	
UNIT V - SRE & SERVICENOW	**9**
Introduction – Adopting a DevOps & SRE Model – SRE vs DevOps – Architecture & Lifecycle – Practices – Error Budgets – Toil Management – DevOps Tools – Introduction to ServiceNow – Reporting & Managing Issue – Benefits.	
TOTAL (L:45) : 45 PERIODS	

REFERENCE BOOKS:

1. Cloud Computing: Concepts, Technology & Architecture by Erl, Thomas, Puttini, Ricardo, Mahmood, Zaigham
2. Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem (Addison-wesley Data & Analytics Series) 1st Edition, Kindle Edition by Douglas Eadline
3. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley, 2015.
4. Machine Learning in the AWS Cloud - Add Intelligence to Applications with Amazon Sage Maker and Amazon Recognition By Abhishek Mishra
5. Deep Learning for Vision Systems By Mohamed Elgendy ·
6. Learning Robotic Process Automation - Create Software Robots and Automate Business Processes with the Leading RPA Tool – UiPath By Alok Mani Tripathi
7. Ui Path, "RPA Design and Development", UiPath Academic Alliance Resource.
8. Hands-on Site Reliability Engineering - Build Capability to Design, Deploy, Monitor, and Sustain Enterprise Software Systems at Scale By Shamayel Mohammed Farooqui Vishnu Vardhan Chikoti.
9. Tim Woodruff, "Learning ServiceNow", 2nd Edition, 2018

17ECX22 – PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP					
		L	T	P	C
		1	0	4	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE -NIL**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To give practice to access the resources, gain knowledge about the technology used and list the ideas for project in the chosen domain.	**1.1**	The students will be able to access the resources, gain knowledge about the technology used and list the ideas for project in the chosen domain.	**a,b,c,d,e,f,g,h,i,j, k,l**	
2.0	To develop an ability to propose a solution document fit to the problem, prepare Solution Architecture, Data Flow Diagram and Technology Architecture.	**2.1**	The students will be able propose a solution document fit to the problem, prepare Solution Architecture, Data Flow Diagram and Technology Architecture.	**a,b,c,d,e,f,g,h,i,j, k,l**	
3.0	To prepare milestones and tasks, sprint schedules, coding and Testing.	**3.1**	The students will be able to prepare milestones and tasks, sprint schedules, coding and Testing.	**a,b,c,d,e,f,g,h,i,j, k,l**	

PHASE I – PREPARATION PHASE	**(3+3)**
Access the resources - Join the mentoring channel - Register on IBM academic Initiative - Create Github account – Setup the System based on pre-requisites.	
PHASE II – IDEATION PHASE	**(3+15)**
Literature Survey – Technology Trainings – Empathy Canvas map Preparation – List the ideas.	
PHASE III – PROJECT DESIGN PHASE - I	**(3+9)**
Proposed solution document preparation – Problem solution fit - Solution Architecture Preparation.	
PHASE IV – PROJECT DESIGN PHASE - II	**(3+9)**
Requirement Analysis - Customer Journey – Data Flow Diagrams – Technology Architecture.	
PHASE V – PROJECT PLANNING PHASE	**(3+3)**
Milestones and Tasks preparation – Sprint Schedules	
PHASE VI – PROJECT DEVELOPMENT PHASE	**(0+21)**
Coding & Solutioning – Acceptance Testing – Performance Testing	
TOTAL (T:15+P:60) = 75 PERIODS	

17ECX23 – SENSORS AND SENSOR CIRCUIT DESIGN					
			L	T	P	C
			3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**			**Related Program Outcomes**
1.0	To know the basics of the sensors and transducers.	**1.1**	The students will be able to design sensors and measure various parameters in sensors.		**a,b,c**
2.0	To learn about the various sensors used for temperature measurement.	**2.1**	The students will be able to design a suitable temperature sensor according to the needs.		**a,b,f**
3.0	To understand the design of the various sensors used for pressure and flow measurement.	**3.1**	The students will be able to design a suitable pressure and flow sensor accordingly.		**a,b,c,d**
4.0	To learn about the various sensors used for displacement and velocity measurement	**4.1**	The students will be able to design a suitable displacement and velocity sensor according to requirement.		**a,b,c,l**
5.0	To understand the concepts of general sensors used for various applications.	**5.1**	The students will be able to demonstrate knowledge of various sensors for different aplications.		**a,b,d,l**

UNIT I – INTRODUCTION	**(9)**
Overview of sensors, sensor circuits, applications, Measurement system architecture, Sensor dynamics, overview of Signal Conditioning, Measurement characteristics, Sensors and Transducers, Basic Interfacing circuits	
UNIT II – TEMPERATURE MEASUREMENT	**(9)**
Principle of operation- Bimetallic thermometer, Resistance Temperature Detectors, Thermistors, Thermocouples, IR thermometers, Integrated circuit temperature transducer	
UNIT III - PRESSURE AND FLOW MEASUREMENT	**(9)**
Principle of operation - Liquid manometers, Resistive transducer, Capacitance transducer, Piezoelectric transducer, Venturi flow meters, Electro-Magnetic flow meter - liquid level measurement using float.	
UNIT IV – DISPLACEMENT AND VELOCITY MEASUREMENT	**(9)**
Linear and angular measurement systems – Resistance potentiometer, strain gauge - capacitive transducers and variable inductance transducers, resolvers, LVDT, proximity sensors, ultrasonic and photo-electric sensors - linear scales - Laser Interferometers, tachogenerator - Encoders: absolute and incremental – Piezoelectric	
UNIT V – OTHER SENSORS	**(9)**
Sensors for measurement of vibration, Acoustics, humidity, weight, volume and radiation - Tactile sensors: force, torque, pressure, Gyroscope - Vision based sensors- Smart sensors	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Peter Elgar , "Sensors for Measurement and Control", Addison-Wesley Longman Ltd, 1998.
2. A K Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai and Co, 2010.

REFERENCES:

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin , "Robotics Engineering: An Integrated Approach", PHI Learning, New Delhi, 2009.
2. Patranabis D, "Sensors and Transducers", Prentice-Hall of India Private Limited, New Delhi, 2003.
3. Ernest O Doebelin, "Measurement systems Application and Design", Tata McGraw-Hill Book Company, 2010.
4. Robert B. Northrop, "Introduction to Instrumentation and Measurements", 3rd Edition, CRC Press, 2014.

17ECX24 – SENSORS AND ACTUATORS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To know the basics of the sensors, transmitters and transducers.	**1.1**	The students will be able to distinguish sensor, transmitter and transducer and how to implement in the circuits.	**a,b,c**	
2.0	To learn the principle of operation and characteristics of capacitive and inductive transducers.	**2.1**	The students will be able to describe the principle of operation and characteristics of capacitive and inductive transducers.	**a,b,c**	
3.0	To understand the basics of actuators and its types.	**3.1**	The students will be able to select actuators according to the needs.	**a,b,c,d**	
4.0	To learn the concept of micro sensors and micro actuators.	**4.1**	The students will be able to illustrate micro sensors and micro actuators with their uses.	**a,b,c,l**	
5.0	To understand the concepts of sensor materials and processing techniques.	**5.1**	The students will be able to demonstrate knowledge about the materials and processing techniques of sensors.	**a,b,d**	

UNIT I - SENSORS	**(9)**
Difference between sensor, transmitter and transducer - Primary measuring elements - selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band. Signal transmission - Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal.	
UNIT II - INDUCTIVE & CAPACITIVE TRANSDUCER	**(9)**
Inductive transducers: - Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer, variable reluctance transducer, synchros, microsyn. Capacitive transducers: - Principle of operation, construction details and characteristics of Capacitive transducers – different types & signal conditioning- Applications: capacitor microphone, capacitive pressure sensor, proximity sensor.	
UNIT III - ACTUATORS	**(9)**
Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria.	
UNIT IV - MICRO SENSORS AND MICRO ACTUATORS	**(9)**
Micro Sensors: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors. Micro Actuators: Actuation principle, shape memor y effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles.	
UNIT V - SENSOR MATERIALS AND PROCESSING TECHNIQUES	**(9)**
Materials for sensors: Silicon, Plastics, metals, ceramics, glasses, nano materials Processing techniques: Vacuum deposition, sputtering, chemical vapour deposition, electro plating, photolithography, silicon micro machining, Bulk silicon micro machining, Surface silicon micro machining, LIGA process.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Patranabis.D, “Sensors and Transducers”, Wheeler publisher, 1994.
2. Jacob Fraden, “Hand Book of Modern Sensors: Physics, Designs and Application” Fourth edition, Springer, 2010.

REFERENCES:

1. Robert H Bishop, "The Mechatronics Hand Book", CRC Press, 2002.
2. Thomas. G. Bekwith and Lewis Buck.N, Mechanical Measurements, Oxford and IBH publishing Co. Pvt. Ltd.
3. Massood Tabib and Azar, "Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures", First edit ion, Kluwer academic publishers, Springer, 1997.

17ECX25 – SMART SENSORS FOR HEALTH CARE APPLICATIONS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To know the basics of the protein based biosensors.	**1.1**	The students will able to understand protein based biosensors and their enzyme reactivity, stability and their applications.	**a,b,c**
2.0	To learn the working principle of DNA based biosensor.	**2.1**	The students will able to describe DNA based biosensors to study the presence of heavy metals in the food products.	**a,b,c**
3.0	To understand the concept of sensors in electro chemical applications.	**3.1**	The students will able to detect fluorescence, UV-Vis and electrochemical applications of biosensors.	**a,b,c,d**
4.0	To learn the processes involved in fabrication of biosensors.	**4.1**	The students will able to describe about the fabrication of biosensors and its applications.	**a,b,c,l**
5.0	To throw a light on the areas of research and emerging trends of sensors in healthcare industry.	**5.1**	The students will able to explore about the future research areas of sensors in healthcare.	**a,b,d,l**

UNIT I – PROTEIN BASED SENSORS FOR HEALTHCARE	**(9)**
Nano structure for enzyme stabilization - Single enzyme nano particles - Nanotubes microporus silica - Protein based nano crystalline Diamond thin film for processing.	
UNIT II – DNA BASED BIOSENSOR	**(9)**
Heavy metal complexing with DNA and its determination water and food samples - DNA zymo biosensors.	
UNIT III - ELECTRO CHEMICAL APPLICATION	**(9)**
Detection in biosensors - Flurorescence - Absorption - Electrochemical. Integration of various techniques - Fibre optic biosensors.	
UNIT IV - FABRICATION OF BIOSENSORS	**(9)**
Techniques used for microfabrication - Microfabrication of electrodes - On chip analysis.	
UNIT V – SMART SENSORS IN RESEARCH FOR HEALTHCARE	**(9)**
Future direction in biosensor research - Designed protein pores-as components of biosensors - Molecular design - Bionanotechnology for cellular biosensing - Biosensors for drug discovery - Nanoscale biosensors	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Biosensors: A Practical Approach, J. Cooper & C. Tass, Oxford University Press, 2004.

REFERENCES:

1. Nanomaterials for Biosensors, Cs. Kumar, Willey - VCH, 2007
2. Smart Biosensor Technology, G.K. Knoff, A.S. Bassi, CRC Press, 2006.

17ECX26 – PRINCIPLES OF ROBOTICS					
			L	T	P	C
			3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**			**Related Program Outcomes**
1.0	To know the basic concepts of Robotics.	**1.1**	The students will be able to understand basic concept of Robotics.		**a,b,c**
2.0	To learn the architecture and topology of software defined radio.	**2.1**	The students will be able to analyze homogenous transformations for Robotics.		**a,b,c,d**
3.0	To understand the concept of direct kinematics.	**3.1**	The students will be able to apply direct kinematics in the design of a bot.		**b,c,d,g,h**
4.0	To learn the the concept of inverse kinematics.	**4.1**	The students will be able to apply inverse kinematics in the design of a bot.		**a,b,c,j,k,l**
5.0	To understand the concept of velocity kinematics.	**5.1**	The students will be able to apply velocity kinematics in the design of a bot.		**a,b,d,g,j,l**

UNIT I – BASIC CONCEPTS	**(9)**
Classification of Robots based on Geometry, Workspace, Actuation, Control and Application - Advantages and Disadvantages of Robots - Robot Components: Link, Joint, Manipulator, Wrist, End-effector : Gripper – Types, Actuator and Sensor - Configuration space – Joint Space – Workspace, Robot Specifications: Number of Axes: Internal and External (7-axis robot) - Capacity and Speed, Reach and Stroke, Tool Orientation, Repeatability, Precision and Accuracy, Operating Environment	
UNIT II – HOMOGENEOUS TRANSFORMATIONS	**(9)**
Degrees of Freedom – Matrix Representation: Representation of a point and vector in space, Global and Local Coordinate axes - Homogeneous Transformation Matrices – Transformations: Representation of pure translation, Representation of pure Rotation - Representation of Combined Transformations - Inverse of Transformation Matrices - Euler Angles – Roll, Pitch, Yaw angles - Quaternions– Spinors and Rotators	
UNIT III - DIRECT KINEMATICS	**(9)**
Denavit- Hartenberg Notation - Transformation between two Adjacent Coordinate Frames, Forward Kinematics of Two, Three, Four, Five and Six axis Robots.	
UNIT IV - INVERSE KINEMATICS	**(9)**
Decoupling Technique - Inverse Transformation Technique - Inverse position: Geometric Approach –Inverse Orientation -Inverse Kinematics of Two, Three, Four, Five and Sixaxis Robots	
UNIT V - VELOCITY KINEMATICS	**(9)**
Angular Velocity – Linear Velocity - Jacobian representation of Linear and Angular Velocity Calculation of Jacobian for Two, Three and Four axis Robots - Inverse Jacobian - Singularities: Wrist and Arm Singularities - Manipulability - Induced joint torques and forces.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Mark W. Spong, Seth Hutchinson, M. Vidyasagar, "Robot Modeling and Control", Wiley, 2012.
2. Niku S B, "Introduction to Robotics, Analysis, Control, Applications", John-Wiley & Sons Inc, 2011.

REFERENCES:

1. Robert J. Schilling, "Fundamentals of Robotics, Analysis and Control", PHI Learning, 2009.
2. Reza N Jazar, "Theory of Applied Robotics", Springer, 2010.
3. Saha S K, "Introduction to Robotics", Tata McGraw Hill Education Pvt. Ltd, 2010.
4. Tadej Bajd, Matjaž Mihelj, Marko Munih, "Introduction to Robotics", Springer, 2013.

17ECX27– ROBOTICS AND CONTROL- THEORY AND PRACTICE					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To know the basic concept of various controls in Robotics.	**1.1**	The students will be able to understand basic concept of various controls in Robotics.	**a,b,c**	
2.0	To learn the various controls for Robot manipulator.	**2.1**	The students will be able to analyze manipulator control and their various applications.	**a,b,f**	
3.0	To understand the differential motion and statics in Robotics.	**3.1**	The students will be able to describe the differential motion and statics in Robotics.	**b,c,d,g,h**	
4.0	To learn the various exoskeletons for Robot.	**4.1**	The students will be able to design various exoskeletons for Robot.	**a,b,c,j**	
5.0	To understand the different percutaneous interventions.	**5.1**	The students will be able to apply various control modes in Robots.	**a,b,d**	

UNIT I – INTRODUCTION	**(9)**
Coordinate Frames and Homogeneous Transformations, Differential Transformations, Transforming Differential Changes between Coordinate Frames, Kinematic Model for Robot Manipulator – Direct and Inverse Kinematics, Manipulator Jacobian, Trajectory Planning, Manipulator Dynamics Multiple Degree of Freedom, Stability of Dynamical System	
UNIT II - MANIPULATOR CONTROL	**(9)**
Biped Robot Basics and Flat Foot Biped Model, Biped Robot Flat Foot and Toe Foot Model, Artificial Neural Network, Neural Network based control for Robot Manipulator.	
UNIT III - MANIPULATOR DIFFERENTIAL MOTION AND STATICS	**(9)**
Redundancy Resolution of Human Fingers in Cooperative Object Translation, Fundamentals of Robot Manipulability, Manipulability Analysis of Human Fingers in Cooperative Rotational Motion.	
UNIT IV - ROBOTIC EXOSKELETONS	**(9)**
Introduction to Robotic Hand Exoskeleton, Design and Development of a Three Finger Exoskeleton, Force Control of an Index Finger Exoskeleton, Neural Control of a Hand Exoskeleton, Neural Control of a Hand Exoskeleton Based on Human Subject's Intention.	
UNIT V – PERCUTANEOUS INTERVENTIONS	**(9)**
Robot Assisted Percutaneous Interventions, Sliding Mode Control, Higher Order Sliding Mode Control, Smart Needles for Percutaneous Interventions, Flexible Link Kinematics, Model Based Control of Robot Manipulators.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi, 4th Reprint, 2005.
2. JohnJ.Craig, Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.

REFERENCES:

1. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
2. K. K.Appu Kuttan, Robotics, I K International, 2007.
3. Edwin Wise, Applied Robotics, Cengage Learning, 2003.

17ECX28– PROGRAMMING FOR ROBOTICS					
			L	T	P	C
			3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**			**Related Program Outcomes**
1.0	To know the basics of the Robot Programming.	**1.1**	The students will be able to write small programs to control various components.		**a,b,c**
2.0	To learn the structure of VAL programs for simple applications.	**2.1**	The students will be able to execute VAL programs for various simple applications.		**a,b,c,d**
3.0	To understand the various commands in RAPID language.	**3.1**	The students will be able to execute programs in RAPID language for various simple applications.		**b,c,d**
4.0	To learn the cognitive radio architecture.	**4.1**	The students will be able to execute VAL programs for various simple applications.		**a,b,c,d,l**
5.0	To understand the concepts of wireless networks and next generation networks.	**5.1**	The students will be able to execute VAL programs for various simple applications.		**a,b,d,i,j,l**

UNIT I – BASICS OF ROBOT PROGRAMMING	**(9)**
Robot programming-Introduction-Types- Flex Pendant- Lead through programming, Coordinate systems of Robot, Robot controller- major components, functions-Wrist Mechanism-Interpolation-Interlock commands-Operating mode of robot, Jogging Types, Robot specifications- Motion commands, end effectors and sensors commands.	
UNIT II - VAL LANGUAGE	**(9)**
Robot Languages-Classifications, Structures- VAL language commands- motion control, hand control, program control, pick and place applications, palletizing applications using VAL, Robot welding application using VAL program-WAIT, SIGNAL and DELAY command for communications using simple applications.	
UNIT III - RAPID LANGUAGE	**(9)**
RAPID language basic commands- Motion Instructions-Pick and place operation using Industrial robot- manual mode, automatic mode, subroutine command based programming. Movemaster command language-Introduction, syntax, simple problems.	
UNIT IV - PRACTICAL STUDY OF VIRTUAL ROBOT	**(9)**
Robot cycle time analysis-Multiple robot and machine Interference-Process chart, Simple problems-Virtual robotics, Robot studio online software-Introduction, Jogging, components, work planning, program modules, input and output signals-Singularities. Collision detection-Repeatability measurement of robot-Robot economics.	
UNIT V – VAL-II AND AML	**(9)**
VAL-II programming-basic commands, applications- Simple problem using conditional statements-Simple pick and place applications-Production rate calculations using robot. AML Language-General description, elements and functions, Statements, constants and variables-Program control statements- Operating systems, Motion, Sensor commands-Data processing.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Deb. S. R. “Robotics Technology and Flexible Automation”, Tata McGraw Hill publishing company limited, 1994.
2. Mikell. P. Groover, “Industrial Robotics Technology”, Programming and Applications, McGraw Hill Co, 1995.

REFERENCES:

1. Klafter. R.D, Chmielewski.T.A and Noggin's, "Robot Engineering : An Integrated Approach", Prentice Hall of India Pvt. Ltd.,1994.
2. Fu .K. S, Gonzalez .R. C. & Lee .C.S.G, "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill Book co, 1987.
3. Craig .J. J, "Introduction to Robotics Mechanics and Control", Addison- Wesley, 1999.

17ECX29 – AI FOR ROBOTICS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To know the basics of AI and intelligent agents.	**1.1**	The students will be able to search solution through uninformed and informed search strategies.	**a,b,c**	
2.0	To learn the architecture and attributes of Robotic Paradigms.	**2.1**	The students will be able to select the proper Robotic paradigm.	**a,b,f**	
3.0	To understand various topological and metric path planning methods.	**3.1**	The students will be able to design various metric path planning methods for Robotics.	**b,c,d,g,h**	
4.0	To learn the sonar sensor model and map making.	**4.1**	The students will be able to apply various sonar sensor models for map making.	**a,b,c,j,k,l**	
5.0	To understand the concepts of learning and natural language processing.	**5.1**	The students will be able to implement speech recognition techniques in bots.	**a,b,d,g,i,j,l**	

UNIT I – INTRODUCTION TO AI AND INTELLIGENT AGENTS	**(9)**
Foundations, History - Intelligent agents, Agents - Nature of Environments, Structure of agents - Problem solving agents - Problem formulation - State space, Search space - Problem reduction - Searching for solutions: Uninformed search strategies – Informed search strategies - Heuristic functions	
UNIT II – ROBOTIC PARADIGMS	**(9)**
Overview of the Three Paradigms - Hierarchical Paradigm: attributes – representative architectures - Reactive paradigm: attributes - subsumption architecture - potential field methodologies - Designing a reactive implementation: a primitive move-to-goal behavior, an abstract follow-corridor behavior - Designing a Reactive Behavioral System - The Hybrid Deliberative/Reactive Paradigm- Attributes - Architectural Aspects- Managerial Architectures- State-Hierarchy Architectures Model-Oriented Architectures	
UNIT III – TOPOLOGICAL AND METRIC PATH PLANNING	**(9)**
Landmarks and gateways - relational methods – associative methods - case study - Metric Planning: Configuration Space-Cspace representations - graph based planners - wavefront based planners - Interleaving Path Planning and Reactive Execution	
UNIT IV – LOCALIZATION AND MAP MAKING	**(9)**
Sonar sensor model - Bayesian – Dampster-Shafer theory - HIMM - comparison of methods - localization – exploration	
UNIT V – LEARNING AND NATURAL LANGUAGE PROCESSING	**(9)**
Forms of learning - NLP: Language models - Natural language for communications - Speech recognition	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Robin R. Murphy, "Introduction to AI Robotics", MIT Press, 2000.
2. Start Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education, New Delhi, 2015

REFERENCES:

1. Francis X. Govers, "Artificial Intelligence for Robotics", Packt, 2018.
2. Roland Siegwart, Illah R. Nourbakhsh , "Introduction to Autonomous Mobile Robots", MIT Press, 2004.
3. Kevin Knight, Elaine Rich, Nair, "Artificial Intelligence", Tata McGraw Hill, New Delhi, 2017.

17ECX30 – ROBOTICS FOR INDUSTRIAL APPLICATIONS				
L	T	P	C	
3	0	0	3	
PREREQUISITE : NIL				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To know the scope and need for industrial robots.	**1.1**	The students will be able to comprehend and appreciate the significance and role of industrial robot in the present contemporary world.	**a,b,c**
2.0	To learn the fundamentals of automation and Robots.	**2.1**	The students will be able to exemplify the features and functionalities of the sensors in Robot.	**a,b,f**
3.0	To understand the basics of Robot programming.	**3.1**	The students will be able to develop different language programs to design and develop robotic based systems.	**b,c,d,g,h**
4.0	To learn the design and control of Robot cell design.	**4.1**	The students will be able to develop system for industrial automation and medical applications.	**a,b,c,j,k,l**
5.0	To understand the concepts of future robot technology.	**5.1**	The students will be able to illustrate the methodologies to provide automatic solution for replacing humans in life threatening area.	**a,b,d,g,i,j,l**

UNIT I – SCOPE OF ROBOTS	**(9)**
The scope of industrial Robots - Definition of an industrial robot - Need for industrial robots -Economic and Social Issues, applications.	
UNIT II – ROBOT COMPONENTS	**(9)**
Fundamentals of Robot Technology - Automation and Robotics - Robot anatomy - Work volume -Precision of movement - End effectors - Sensors.	
UNIT III – ROBOT PROGRAMMING	**(9)**
Robot Programming - Methods - interlocks textual languages. Characteristics of Robot level languages, characteristic of task level languages.	
UNIT IV – ROBOT WORK CELL	**(9)**
Robot Cell Design and Control - Remote Center compliance - Safety in Robotics.	
UNIT V – FUTURE TRENDS	**(9)**
Telepresence robot, Autonomous mobile robots, Walker Robots, Solar-ball Robot, Underwater bots, Aerobots	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Robert J. Schilling, "Fundamentals of Robotics- Analysis and Control", Pearson Education, 2006.
2. John M. Holland, "Designing Autonomous Mobile Robots-Inside the mind of an Intelligent Machine", Newnes Publication, 2004.

REFERENCES:

1. Mikell P.Groover, Mitchell Weiss, Roger N.Nagel Nicholas G.Odrey, "Industrial Robotics Technology, Programming and Applications", McGraw Hill Book Company 1986.
2. John Iovine, "Robots, Android and Animatronics", Second Edition, McGraw-Hill, 2012.

17ECX31– IMAGE SIGNAL PROCESSING				
L	T	P	C
3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To study the image fundamentals necessary for image processing.	1.1	The students will be able to know the image formation and the role human visual system plays in perception of Gray and color image data.	a,bi,j,l
2.0	To enable the student to know about unitary transforms and its properties.	2.1	The students will be able to apply transform-domain representation of images.	a,b,c,f,j
3.0	To study the concept of enhancement and restoration techniques.	3.1	The students will be able to perform image analysis by designing spatial and frequency domain filters.	b,c,d,k,l
4.0	To study the concept of compression and segmentation techniques.	4.1	The students will be able to describe how digital images are represented and stored efficiently depending on the desired quality	a,b,c,d,k
5.0	To understand the concepts of color image processing.	5.1	The students will be able to apply various techniques for color mage processing.	a,b,i,j,l

UNIT I – DIGITAL IMAGE FUNDAMENTALS AND MATRIX THEORY	**(9)**
Digital Image fundamentals: representation, elements of visual perception, simple image formation model, image sampling and quantization, basic relationship between pixels, imaging geometry Review of Matrix theory results: Row and Column ordering, Doubly Block Toeplitz for 2 D linear convolution, Doubly Block Circulant Matrices for circular convolution, Kronecker products, Unitary and orthogonal matrices	
UNIT II - UNITARY TRANSFORMS FOR IMAGE PROCESSING	**(9)**
General Unitary Transforms, DFT, DCT, DST, Hadamard Transform, Haar Transform, Karhunen Loeve Transform.	
UNIT III - IMAGE ENHANCEMENT AND RESTORATION	**(9)**
Spatial Domain enhancement: gray level transformations–histogram equalization-Image averaging-Spatial filtering: Smoothing, Sharpening filters- Frequency domain filters: Smoothing-Sharpening filters-Homomorphic filtering. Image Restoration: Degradation model-Unconstrained and Constrained restoration-Inverse filtering-Wiener filtering.	
UNIT IV - IMAGE COMPRESSION AND SEGMENTATION	**(9)**
Need for data compression-Error free compression-Variable length coding-Bit-Plane coding-Lossless and Lossy Predictive coding, JPEG and MPEG Compression Standards. Image Restoration: Point- Line and edge detection-Thresholding – Region based segmentation: Region splitting and merging.	
UNIT V – COLOR IMAGE PROCESSING	**(9)**
Color models- RGB, CMY, YIQ, HIS, Pseudo coloring, intensity slicing, gray level to color transformation.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Digital Image Processing- Gonzalez and Woods, Pearson education, 2002.
2. Fundamentals of Digital Image Processing – A K Jain, Pearson education, 2003.

REFERENCES:

1. Digital Image Processing- W K Pratt, John Wiley, 2004
2. Digital Signal and Image Processing- Tamal Bose, John Wiley publishers.
3. Two dimensional signal and Image Processing- J S Lim, Prentice Hall.

17ECX32– DIGITAL VIDEO SIGNAL PROCESSING					
			L	T	P	C
			3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**			**Related Program Outcomes**
1.0	To study the basic steps involved in video processing.	**1.1**	The students will be able to analyze the various image formation models for video.		**a,b,c**
2.0	To enable the student to know about Various motion estimation and detection schemes.	**2.1**	The students will be able to apply transform-domain representation of images.		**a,b,f**
3.0	To understand the different coding methods to be applied for video.	**3.1**	The students will be able to apply various coding techniques for motion estimation.		**b,c,d,g,h**
4.0	To explore the concept of video segmentation, tracking and optimization.	**4.1**	The students will be able to track video with 2D, 3D motion using various methods.		**a,b,c,j,k,l**
5.0	To throw light on real time applications of video processing.	**5.1**	The students will be able to apply video processing techniques for real time applications.		**a,b,d,g,i,j,l**

UNIT I – BASIC STEPS OF VIDEO PROCESSING	**(9)**
Analog video, Digital Video, Time varying Image Formation models: 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals, filtering operations.	
UNIT II - 2-D MOTION DETECTION AND ESTIMATION	**(9)**
Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion detection and estimation, Motion Compensated Filtering.	
UNIT III - WAVEFORM BASED CODING	**(9)**
Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.	
UNIT IV – VIDEO SEGMENTATION, TRACKING AND OPTIMIZATION	**(9)**
Video Segmentation, Motion Segmentation, Motion Tracking in Video, 2D and 3D Motion Tracking in Digital Video, Methods using Point Correspondences, Optical Flow and Direct Methods, Pel-Recursive Methods, Bayesian Methods	
UNIT V – APPLICATIONS	**(9)**
Video Stabilization and Mosaicing, A Unified Framework for Video Indexing, Summarization, Browsing and Retrieval, Video Surveillance	
	TOTAL (L:45) = 45 PERIODS
TEXT BOOKS: 1. Yao wang, Joem Ostarmann and Ya – quin Zhang, "Video processing and communication ",1st edition , PHI.	
REFERENCES: 1. M. Tekalp ,"Digital video Processing", Prentice Hall International.	

17ECX33 – DIGITAL SPEECH PROCESSING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To study the basic concepts and models Speech signal processing.	**1.1**	The students will be able to analyze the various models for speech signal.	**a,b,c**	
2.0	To enable the student to know about various time domain models of Speech signals.	**2.1**	The students will be able to process the speech signal using different time domain models.	**a,b,f**	
3.0	To understand the short time Fourier analysis for speech signal.	**3.1**	The students will be able to apply short time Fourier analysis for speech signal.	**b,c,d,g,h**	
4.0	To explore the various concepts of Linear Predictive coding and its applications.	**4.1**	The students will be able to solve LPC using different methods and use in real time applications.	**a,b,c,j,k,l**	
5.0	To throw light on various speech recognition methods.	**5.1**	The students will be able to apply speech processing techniques for real time applications.	**a,b,d,g,i,j,l**	

UNIT I – SPEECH SIGNAL MODELS	**(9)**
Introduction: Speech Signal characteristics - Overview of Digital Speech Processing - Speech Production Mechanism - Acoustic Theory of Speech Production: Sound Propagation, Effects of Losses in Vocal Tract, Vocal Tract Transfer Function for Vowels, Sound Excitation in Vocal Tract-Lossless Tube Models: Wave Propagation, Boundary Conditions, Transfer functions, Sound Excitation in Vocal Tract – Digital Models for Speech Signal: Vocal Tract, Radiation, Excitation, Complete Model.	
UNIT II - TIME DOMAIN MODELS	**(9)**
Time Dependent Processing of Speech - Short Time Energy and Average Magnitude - Short time Zero Crossing Rate - Pitch Period Estimation - Short time Auto correlation Function - Median Smoothing.	
UNIT III - SHORT TIME FOURIER ANALYSIS	**(9)**
Definitions and Properties - Design of Digital Filter Banks: Filter design using IIR and FIR filters – Pitch Detection - Analysis-by-Synthesis - Homomorphic Speech Processing: Complex Cepstrum, Formant Estimation, Homomorphic Vocoder.	
UNIT IV – LINEAR PREDICTIVE CODING	**(9)**
Basic Principle - Solution of LPC equations: Cholesky decomposition method, Durbin"s method, Lattice formulation - Frequency domain interpretation of Linear Predictive Analysis - Relation between various Speech Parameters - Applications of LPC: Pitch Detection, Formant Analysis, LPC Voder, Voice Excited LPC Vocoder.	
UNIT V – SPEECH PROCESSING FOR MAN-MACHINE COMMUNICATION	**(9)**
Voice Response Systems - Speaker Recognition Systems: Speaker Verification and Identification Systems - Speech Recognition Systems: Isolated Digit Recognition, Continuous Digit Recognition, Large Vocabulary Word Recognition System.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Rabiner L R and Schaffer R W, Digital Processing of Speech Signals, Pearson Education - India, New Delhi, 2010.
2. Thomas F Quatieri, Discrete Time Speech Signal Processing, Pearson Education - India, New Delhi, 2011.

REFERENCES:

1. Owens FJ, Signal Processing of Speech, Macmillan, New York, 2013.
2. Rabiner L R and K Juang B H, Fundamentals of speech Recognition, Pearson Education - India, New Delhi, 2011.
3. Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, John Wiley and Sons, 1999.

17ECX34 – PATTERN RECOGNITION					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To study the basic of pattern recognition and different algorithms.	**1.1**	The students will be able to analyze the pattern recognition algorithms for classifications.	**a,b,c,d,e,f,l**
2.0	To know the various methods involved in unsupervised classification.	**2.1**	The students will be able to apply the unsupervised learning techniques for pattern classification.	**a,b,c,d,e,f,l**
3.0	To understand the different structural pattern recognition methods.	**3.1**	The students will be able to explain the concepts of structural pattern recognition.	**a,b,c,d,e,f,l**
4.0	To explore the concept of feature extraction and selection methods.	**4.1**	The students will be able to analyze the feature extraction and selection techniques.	**a,b,c,d,e,f,l**
5.0	To throw light on non-metric methods for pattern classification.	**5.1**	The students will be able to analyze the advanced neural network structures for pattern recognition.	**a,b,c,d,e,f,l**

UNIT I – PATTERN CLASSIFIER	**(9)**
Overview of pattern recognition - Discriminant functions - Supervised learning - Parametric estimation - Maximum likelihood estimation - Bayesian parameter estimation - Perceptron algorithm - LMSE algorithm -Problems with Bayes approach - Pattern classification by distance functions - Minimum distance pattern classifier.	
UNIT II - UNSUPERVISED CLASSIFICATION	**(9)**
Clustering for unsupervised learning and classification - Clustering concept - C-means algorithm - Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clustering solutions.	
UNIT III – STRUCTURAL PATTERN RECOGNITION	**(9)**
Elements of formal grammars - String generation as pattern description - Recognition of syntactic description -Parsing - Stochastic grammars and applications.	
UNIT IV – FEATURE EXTRACTION AND SELECTION	**(9)**
Entropy minimization - Karhunen - Loeve transformation - Feature selection through functions approximation -Binary feature selection.	
UNIT V – NON-METRIC METHODS FOR PATTERN CLASSIFICATION AND APPLICATIONS	**(9)**
Non-numeric data or nominal data. Decision trees: Classification and Regression Trees (CART). Applications: Face recognition - preprocessing, face detection algorithms, selection of representative patterns, classification algorithms, results and discussion.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001.
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.

REFERENCES:

1. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
2. P.A Devijver and J. Kittler, Pattern Recognition: A Statistical Approach, Prentice-Hall International, Englewood Cliffs, NJ, 1980
3. K. Fukunaga, Introduction to Statistical Pattern Recognition, 2nd Ed. Academic Press, New York, 1990.

17ECX35 – MEDICAL IMAGE ANALYSIS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**			**Related Program Outcomes**
1.0	To know the medical imaging techniques for image acquisition.	**1.1**	The students will be able to identify the nuclear medical imaging techniques for acquisition of images.		**a,b,c,d,e,l**
2.0	To learn the mathematical preliminaries for image reconstruction.	**2.1**	The students will be able to apply 2D and 3D transforms required for image reconstruction.		**a,b,c,d,e,l**
3.0	To understand the design of fluoroscopy, CT, X-ray and image quality influences.	**3.1**	The students will be able to analyze the x-ray medical imaging techniques and its imaging quality.		**a,b,c,d,e,l**
4.0	To learn the concepts of MRI and spectroscopy..	**4.1**	The students will be able to apply the concept of Neuro Magnetic Science in MRI.		**a,b,c,d,e,l**
5.0	To understand the concepts of ultrasound and neuromagnetic imaging.	**5.1**	The students will be able to analyze the principle and operation modes of Ultrasound Imaging.		**a,b,c,d,e,l**

UNIT I – ACQUISITION OF IMAGES	**(9)**
Introduction to Imaging Techniques - Single crystal scintillation camera - Principles of scintillation camera - multiple crystal scintillation camera - solid state camera - rectilinear scanner- Emission computed Tomography.	
UNIT II - MATHEMATICAL PRELIMINARIES FOR IMAGE RECONSTRUCTION	**(9)**
Image Reconstruction from Projections in Two dimensions- Mathematical Preliminaries for Two and Three dimensional Image Reconstructions - Radon Transform- Projection Theorem - central slice Theorem- Sinogram- Two Dimensional Projection Reconstruction- Three Dimensional Projection Reconstruction- Iterative Reconstruction Techniques.	
UNIT III – FLUOROSCOPY, CT, IMAGE QUALITY	**(9)**
Digital fluoroscopy- Automatic Brightness control - cinefluorography- Principles of computed Tomographic Imaging - Reconstruction algorithms - Scan motions- X-ray sources. Influences of Images quality: Unsharpness- contrast - Image Noise.	
UNIT IV – MAGNETIC RESONANCE IMAGING AND SPECTROSCOPY	**(9)**
Fundamentals of magnetic resonance- overview -Pulse techniques- spatial encoding of magnetic resonance imaging signal- motion suppression techniques- contrast agents- tissue contrast in MRI- fMRI.	
UNIT V - ULTRASOUND, NEUROMAGNETIC IMAGING	**(9)**
Ultrasound: Presentation modes- Time required to obtain Images- System components, signal processingdynamic Range- Ultrasound Image Artifacts- Quality control, Origin of Doppler shift- Limitations of Doppler systems.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. J William R. Hendee, E. Russell Ritenour, Medical Imaging Physics: A John Wiley & sons, Inc., Publication, Fourth Edition 2002.
2. A. C. Kak and M. Slaney, Principles of Computerized Tomography, Society of Industrial and Applied Mathematics, 2001.

REFERENCES:

1. Z.H. Cho., J-oie, P. Jones and Manbir Singh,Foundations of Medical Imaging: John Wiley and sons Inc.
2. Avinash C. Kak, Malcolm Shaney, "Principles of Computerized Tomographic Imaging", IEEE Press, Newyork-1998.

17ECX37 – COMPUTER VISION					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To know the basics of Embedded systems and programming.	**1.1**	The students will be able to interpret the architecture and instruction sets in Embedded systems.	**a,b,c**	
2.0	To learn various techniques in Embedded programming.	**2.1**	The students will be able to write programs using registers and interrupts.	**a,b,f**	
3.0	To understand the programming for various applications.	**3.1**	The students will be able to implement programming for various applications.	**b,c,d,g,h**	
4.0	To learn the integration of hardware and software of embedded systems.	**4.1**	The students will be able to interface hardware and software and embed program to the target system.	**a,b,c,j,k,l**	
5.0	To understand the concepts of Real time operating Systems.	**5.1**	The students will be able to do programming for RTOS.	**a,b,d,g,i,j,l**	

UNIT I – INTRODUCTION	**(9)**
Embedded system overview and applications - features and architecture considerations-ROM - RAM - timers - data and address bus - Memory and I/O interfacing concepts - memory mapped I/O. CISC Vs RISC design philosophy - Von-Neumann Vs Harvard architecture - instruction set - instruction formats - and various addressing modes. Fixed point and floating point arithmetic operations.	
UNIT II – BASIC EMBEDDED PROGRAMMING TECHNIQUES	**(9)**
Introduction to TIVAARM Cortex M4 - Key Features - Functional Block Diagram - Pin Configuration - I/O pin multiplexing - pull up/down registers - GPIO control - Memory Mapped Peripherals - programming System registers - Watchdog Timer - need of low power for embedded systems - System Clocks and control - Hibernation Module on Tiva - Active vs Standby current consumption. Introduction to Interrupts - Interrupt vector table - interrupt programming.	
UNIT III – TIMERS, PWM AND MIXED SIGNAL PROCESSING	**(9)**
Timer - Basic Timer - Real Time Clock (RTC) - Timing generation and measurements - Analog interfacing and data acquisition: ADC - Analog Comparators - DMA - Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).	
UNIT IV – HARDWARE/SOFTWARE INTEGRATION	**(9)**
Host and Target Machines. In-System Programming (ISP)-In-Application Programming (IAP)-Getting Embedded Software into Target System: Programmers. Display - Keyboard - Relay - Stepper and DC Motor Interfacing.	
UNIT V – REAL TIME OPERATING SYSTEMS	**(9)**
Survey of Software Architectures - Tasks and Task States - Tasks and Data - Semaphores and Shared Data - Message Queues - Mailboxes and Pipes - Timer functions - Events - Memory Management and Interrupt Routines in RTOS Environment. Study of embedded product design with real time concepts using RTOS.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Jonathan W Valvano, "Introduction to Arm Cortex -M Microcontrollers", 2012.
2. David E Simon, "An Embedded Software Primer", Pearson Education Asia, 2009.

REFERENCES:

1. Rajkamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw-Hill, 2008.
2. Andrew Sloss & Dominic Symes & Chris Wright, "ARM System Developer's Guide", 1st Edition, Elsevier, Morgan Kaufmann Publishers 2004.

17ECX38 – DEEP LEARNING FOR VISUAL COMPUTING				
L	T	P	C
3	0	0	3

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To know the basics of machine learning principles.	**1.1**	The students will be able to infer the mathematical background and significance of Machine Learning Principles.	**a,b,c**
2.0	To learn the basics of neural networks.	**2.1**	The students will be able to apply the mathematical background and significance of Artificial Neural Networks in Deep Learning.	**a,b,f**
3.0	To understand the operation of ANN for deep learning.	**3.1**	The students will be able to analyze the operation of ANN for Deep Learning.	**b,c,d,g,h**
4.0	To learn the supervised and unsupervised models of ANN.	**4.1**	The students will be able to analyze the Supervised and Unsupervised models of ANN for Deep Learning.	**a,b,c,j,k,l**
5.0	To understand the concepts of real world applications of Deep Learning.	**5.1**	The students will be able to analyze the recent developments and real world examples of Deep Learning Networks.	**a,b,d,g,i,j,l**

UNIT I – INTRODUCTION TO MACHINE LEARNING	**(9)**
Overview of machine learning, linear classifiers, loss functions, Stochastic gradient descent and contemporary variants, back-propagation.	
UNIT II – INTRODUCTION TO NEURAL NETWORKS	**(9)**
Activation functions, initialization, regularization, batch normalization, model selection, ensembles, Fundamentals, architectures, pooling, visualization.	
UNIT III – NEURAL NETWORK IN ACTION	**(9)**
Transposed convolution, efficient pooling, object detection, semantic segmentation, Recurrent neural networks (RNN), long-short term memory (LSTM), language models, machine translation, image captioning, video processing, visual question answering, video processing, learning from descriptions, attention.	
UNIT IV – DEEP GENERATIVE MODELS	**(9)**
Auto-encoders, variational auto-encoders, generative adversarial networks, autoregressive models, generative image models, unsupervised and self-supervised representation learning.	
UNIT V – DEEP REINFORCEMENT LEARNING	**(9)**
Policy gradient methods, Q-Learning, Real World Applications of Deep Learning Techniques.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. I. Goodfellow, Y. Bengio, A. Courville, Deep Learning, MIT Press, 2016.

REFERENCES:

1. K. P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

17ECM01 – FUNDAMENTALS OF SEMICONDUCTOR DEVICES					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To know the basics of electronic states and energy band structure formation.	**1.1**	The students will be able to know basics of electronic states and energy band structure formation.	**a,b,c**	
2.0	To know the importance of carrier concentration and doping in semiconductors.	**2.1**	The students will be able to know the importance of carrier concentration and doping in semiconductors.	**a,b,c**	
3.0	To understand physics of transport of charge carriers.	**3.1**	The students will be able to understand physics of transport of charge carriers.	**a,b,c**	
4.0	To understand physics of transport of charge carriers.	**4.1**	The students will be able to know the importance of optical properties of materials.	**a,b,c**	
5.0	To understand the concepts of physics of devices and importance of quantum structures.	**5.1**	The students will be able to understand the.	**a,b,c**	

UNIT I – ELECTRONIC STATES	**(9)**
Crystal structures -reciprocal lattice – Brillouin zone and band representation. Dynamics of electrons in periodic potential: Kronig-Penny and nearly free electron models – band structure calculations -band structures of real semiconductors. Band gaps in semiconductors: Holes and effective mass concept – properties of conduction and valence bands.	
UNIT II - CARRIERS AND DOPING	**(9)**
Fermi distribution and energy – Density of states – valence and conduction band density of states – intrinsic concentration – intrinsic Fermi level – n and p type doping – density of carriers in extrinsic semiconductors and their temperature dependence – extrinsic semiconductor Fermi energy level – degenerate and non-degenerate semiconductors – band-gap engineering –electrons and holes in quantum wells and superlattices.	
UNIT III – ELECTRICAL TRANSPORT	**(9)**
Scattering in semiconductors – Velocity-electric field relations: Low field response; mobility and high field transport. Very high field transport: Breakdown phenomena – avalanche breakdown - Zener tunneling. Carrier transport by diffusion – transport by drift and diffusion: Einstein's relation. Charge injection and quasi-Fermi levels.	
UNIT IV – OPTICAL TRANSPORT	**(9)**
Electron –hole pair generation and recombination: band to band and intra band transitions, free – carrier and phonon transitions. Excitons: Origin, electronic levels and properties. Radiative recombination (Shockely – Read- Hall and Auguer) processes. Carrier transport: continuity equations. Optical constants: Kramers – Kronigrelations – Electron-phonon interaction – Semiconductor laser.	
UNIT V - DEVICES	**(9)**
Processing of semiconductor devices: crystal growth, doping, deposition of dielectric films, lithography and metallization – p-n semiconductor junctions – homo and hetero junctions. MOS diode and MOSFET. Semiconductor quantum structures, density of states and excitons. Semiconductor photonic structures: 1D, 2D and 3D photonic crystals. Active and passive optoelectronic devices: photo processes.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. R.F.Pierret, "Semiconductor Device Fundamentals", Pearson, 2006.
2. D.Neamen and D.Biswa, "Semiconductor physics and devices", McGraw Hill Education, 2017.

REFERENCES:

1. N.Garcia, A. Damask and S.Schwarz “Physics for Computer Science Students”, SpringerVerlag, 2012.
2. Umesh Mishra and Jasprit Singh, “Semiconductor Device Physics and Design”, Springer, 2008.
3. Nandita Dasgupta and Amitava Dasgupta, “Semiconductor Devices: Modelling and Technology”, PHI Learning Pvt. Ltd., 2004.

17ECM02 – SEMICONDUCTOR DEVICES AND CIRCUITS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To know the basics of the software defined radio.	**1.1**	Know basics of electronic states and energy band structure formation.	**a,b,c**	
2.0	To learn the architecture and topology of software defined radio.	**2.1**	Know the importance of carrier concentration and doping in semiconductors.	**a,b,f**	
3.0	To understand the design of the wireless networks based on the cognitive radios	**3.1**	Understand physics of transport of charge carriers.	**b,c,d,g,h**	
4.0	To learn the cognitive radio architecture.	**4.1**	Know the importance of optical properties of materials.	**a,b,c,j,k,l**	
5.0	To understand the concepts of wireless networks and next generation networks.	**5.1**	Understand the physics of devices and importance of quantum structures.	**a,b,d,g,i,j,l**	

UNIT I - SEMICONDUCTOR DIODES	**(9)**
PN junction diode - Current equations - Diffusion and Drift Current Densities - Forward and Reverse bias characteristics - Switching Characteristics.	
UNIT II - BIPOLAR JUNCTION TRANSISTIORS	**(9)**
NPN and PNP – Junctions - Early effect - Current equations – Input and Output characteristics of CE, CB, CC Configurations - Hybrid -π model - Ebers Moll Model - Transistor as an amplifier.	
UNIT III -FIELD EFFECT TRANSISTORS	**(9)**
JFET – Drain and Transfer Characteristics - Current equations - Pinch off voltage and its significance, MOSFET – Characteristics - Threshold voltage - Channel length modulation - D-MOSFET - E-MOSFET Current equation - FINFET - DUAL GATE MOSFET.	
UNIT IV - SPECIAL SEMICONDUCTOR DEVICES	**(9)**
Metal-Semiconductor Junction – MESFET – Schottky barrier diode - Zener diode - Varactor diode – Tunnel diode – PIN diode - LASER diode - LDR.	
UNIT V - POWER DEVICES AND DISPLAY DEVICES	**(9)**
UJT - SCR - Diac - Triac - Power BJT - Power MOSFET - DMOS – VMOS, LED – LCD - Photo transistor - Opto-Coupler - Solar cell - CCD.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. R David A. Bell, “Electronic Devices and Circuits”, Oxford University Press, Fifth Edition, (2008).
2. Jacob Millman & Christos C. Halkias, “Electronic Devices and Circuits”, McGraw Hill, 2nd Edition, 2007.
3. D.Neamen and D.Biswa, “Semiconductor physics and devices”, McGraw Hill Education, 2017.

REFERENCES:

1. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, “Electronic Devices and Circuits”, Tata McGraw Hill Third Edition (2013).
2. R.L. Boylestad & L. Nashelsky, “Electronic Devices and Circuit Theory”, PHI Learning Private Limited, Ninth Edition, 2008.

17ECM03 – SEMICONDUCTOR DEVICE MODELLING AND SIMULATION					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To know the basics of the software defined radio.	**1.1**	Know basics of electronic states and energy band structure formation.	**a,b,c**	
2.0	To learn the architecture and topology of software defined radio.	**2.1**	Know the importance of carrier concentration and doping in semiconductors.	**a,b,f**	
3.0	To understand the design of the wireless networks based on the cognitive radios	**3.1**	Understand physics of transport of charge carriers.	**b,c,d,g,h**	
4.0	To learn the cognitive radio architecture.	**4.1**	Know the importance of optical properties of materials.	**a,b,c,j,k,l**	
5.0	To understand the concepts of wireless networks and next generation networks.	**5.1**	Understand the physics of devices and importance of quantum structures.	**a,b,d,g,i,j,l**	

UNIT I – Si-BASED NANOELECTRONICS	**(9)**
Si-Based Nanoelectronics and Device Scaling, Nanoscale and Heterostructure Devices, Crystal structure-Unit cell and Miller Indices, Reciprocal Space, Doping, Band Structure, Effective Mass	
UNIT II - PN JUNCTION DIODE	**(9)**
Density of states, Electron Mobility, Semiconductor Statistics- Fermi-Dirac function and carrier concentration calculation, p-n junction under equilibrium, derivation of I-V relation, Minority carrier diffusion equation, Non-idealities in the p-n junction diode (Breakdown and Generation-Recombination currents).	
UNIT III - BIPOLAR JUNCTION TRANSISTIORS	**(9)**
Transistor configurations, BJT- I-V relation and gain, Ebers-Moll model, Non-idealities in BJT, Gummel Poon Model, HBT, BJT Transient and small signal behavior, Metal-Semiconductor contact (Schottky Barrier/Diode, Ohmic Contacts) and capacitance characteristics, Thermionic emission current flow and fermi-level pinning	
UNIT IV - FIELD EFFECT TRANSISTORS	**(9)**
Field Effect Transistors (JFET, MESFET, HEMT), MOS Band diagram and C-V characteristics, Threshold voltage and Interface charges, MOSFET I-V, gradual channel approximation and frequency response, non-idealities and CMOS	
UNIT V - SEMICLASSICAL TRANSPORT THEORY	**(9)**
Semiclassical Transport Theory -: Distribution Function, Boltzmann Transport Equation (BTE), Relaxation-Time Approximation (RTA), Scattering and Mobility. Drift-Diffusion Model Derivation and dielectric relaxation time, Taylor series expansion and Finite Difference method, Normalization, Scaling and Linearization of Poisson's Equation and Scharfetter–Gummel Discretization of the Continuity Equation	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. R David A. Bell, "Electronic Devices and Circuits", Oxford University Press, Fifth Edition, (2008).
2. Jacob Millman & Christos C. Halkias, "Electronic Devices and Circuits", McGraw Hill, 2nd Edition, 2007.

REFERENCES:

1. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, “Electronic Devices and Circuits”, Tata McGraw Hill Third Edition (2013).
2. R.L. oylestad & L. Nashelsky, “Electronic Devices and Circuit Theory”, PHI Learning Private Limited, Ninth Edition, 2008.

17ECM04 – BASIC ELECTRONICS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**			**Related Program Outcomes**
1.0	To know the basics of Semiconductors, diodes, transistors and FET.	**1.1**	The students will be able to apply the diodes, transistors and FET in regulators and amplifiers and analyze their characteristics.		**a,b,c,d**
2.0	To learn the various functional characteristics of operational amplifiers.	**2.1**	The students will be able to illustrate the working of analog IC with different configurations and its applications.		**a,b,c,d**
3.0	To understand the design of basic digital combinational circuits.	**3.1**	The students will be able to simplify Boolean expressions using K-map and implement combinational circuits.		**a,b,c,d**
4.0	To learn the working principle of flip-flops, Shift Registers and Memories.	**4.1**	The students will be able to analyze the Flip flops, shift registers and memory configurations in digital circuits.		**a,b,c,d**
5.0	To understand the concepts involved in A/D and D/A converters.	**5.1**	The students will be able to classify and analyze A/D and D/A converters with its parameters.		**a,b,c,d**

UNIT I – INTRODUCTION	**(9)**
Semiconductors overview: intrinsic & extrinsic, energy band diagram - Mobility - Electrons and holes - The P-N junction diode - Zener diode - Avalanche effect- Rectifier Circuits Half wave, Full wave circuits, Efficiency, PIV, Ripple factor and AC and DC current and voltage in rectifier. PNP and NPN Bipolar junction Transistors - H parameters equivalent circuit – Common emitter amplifier - DC behavior: the load slope and the Q point - AC behavior - Emitter follower amplifier - Field effect transistors: JFET and MOSFET.	
UNIT II – OPERATIONAL AMPLIFIERS: DC PERFORMANCE	**(9)**
The operational amplifier - Input resistance, Output resistance, Open loop gain - Bias currents – Offset currents - Offset voltage - Differential mode gain - Common mode gain - Common mode rejection ratio - Negative feedback - Open loop gain and closed loop gain - Inverter amplifier - Non-inverter amplifier - The voltage follower - Differential amplifier. Adders, Subtractors, Comparator, Integrator and Differentiator.	
UNIT III – DIGITAL TECHNIQUES : COMBINATIONAL CIRCUITS	**(9)**
Numbering systems - Binary, octal and hexadecimal numbers - Boole algebra - Conversion and operations - AND gate- OR gate - Inverter - NAND gate - NOR gate - Exclusive OR gate. Morgans laws. Combinational Circuits: Truth tables, logic expressions, Logic simplification using K- map, half and full adder/subtractor, multiplexers, demultiplexers, Logic families : TTL and CMOS.	
UNIT IV – DIGITAL TECHNIQUES: SEQUENCIAL CIRCUITS	**(9)**
Gated Latches & Flip Flops- Level triggered and Edge triggered Flip-Flops, Flop (FF) types: RS type. JK FF. JK FF Master slave. D FF. T FF. Flip Flop Conversion. Shift registers, Counters. Memories Structure: address and data bus. ROM, PROM, EPROM and flash RAM. Volatiles Memories: RAM, SRAM, DRAM. Addressing modes.	
UNIT V – DIGITAL TO ANALOG CONVERTERS AND ANALOG TO DIGITAL CONVERTERS	**(9)**
DAC: Input latch. Binary Weighted Resistor Network. R-2R Ladder Resistor Network.Pulse Width Modulation. Resolution. Accuracy. Linearity. Zero Offset. Settling Time. Glitches. ADC: Sampling. Real time sampling and equivalent time sampling. Sampling theorem (Nyquist). Sampling and holding. Conversion.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. J L Robert Boylestead, Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education, 2012.
2. M.Morris Mano, Michael D Ciletti, "Digital Design", 4th edition Pearson, 2011.

REFERENCES:

1. D.RoyChoudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2000.
2. Thomas L.Floyd, "Digital Fundamentals", Prentice Hall, 11th Edition, 2015.

17ECM05 – SEMICONDUCTOR OPTOELECTRONICS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**			**Related Program Outcomes**
1.0	To know the basics of light sources and semiconductor Physics.	**1.1**	The students will be able to describe various properties of light and semiconductor devices.		**a,b,c**
2.0	To learn the working principle of optical sources.	**2.1**	The students will be able to explain the working of different optical sources.		**a,b,c**
3.0	To understand the basic of optical detectors.	**3.1**	The students will be able to design optical detectors for the required applications.		**a,b,c**
4.0	To learn the construction and working of optoelectronic modulating devices..	**4.1**	The students will be able to design optoelectronic modulators.		**a,b,c**
5.0	To understand the concepts integrated optoelectronic circuits.	**5.1**	The students will be able to explore the concept of optoelectronic Integrated circuits.		**a,b,c**

UNIT I – LIGHT SOURCES AND SEMICONDUCTOR PHYSICS	**(9)**
Wave nature of light, Polarization, Interference, Diffraction, Light Source, review of Quantum Mechanical concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.	
UNIT II – OPTICAL SOURCES	**(9)**
Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of Lasers, Mode Locking, laser applications.	
UNIT III – OPTICAL DETECTORS	**(9)**
Photo detector, Thermal detector, Photo Devices, Photo Conductors, Photo diodes, Detector Performance.	
UNIT IV – OPTOELECTRONIC MODULATING DEVICES	**(9)**
Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acoustoptic devices, Optical, Switching and Logic Devices.	
UNIT V – INTEGRATED OPTOELECTRONIC CIRCUITS	**(9)**
Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. J. Wilson and J.Haukes, "Opto Electronics – An Introduction", Prentice Hall of India Pvt. Ltd., New Delhi, 1995.

REFERENCES:

1. Bhattacharya "Semiconductor Opto Electronic Devices", Prentice Hall of India Pvt., Ltd., New Delhi, 1995.
2. Jasprit Singh, "Opto Electronics – As Introduction to materials and devices", McGraw-Hill International Edition, 1998.

17ECM06 – MICRO ELECTRO MECHANICAL SYSTEMS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To introduce the concepts of micro electro mechanical devices.	**1.1**	The students will be able to describe the concepts of MEMS and its applications.	**a,b,c,d**	
2.0	To understand the materials required for manufacturing MEMS.	**2.1**	The students will be able to choose required materials for manufacturing MEMS.	**a,b,c,d**	
3.0	To know the fabrication process of microsystems.	**3.1**	The students will be able to design a system using MEMS components.	**a,b,c,d**	
4.0	To understand the design concepts of micro sensors.	**4.1**	The students will be able to design various MEMS sensors.	**a,b,c,d**	
5.0	To explore the design concepts of micro actuators.	**5.1**	The students will be able to design micro actuators.	**a,b,c,d**	

UNIT I – INTRODUCTION	**(9)**
New trends in Engineering and Science: Micro scale systems-Introduction to Design of MEMS, Overview of Micro electro mechanical Systems, Applications of Micro electro mechanical systems.	
UNIT II – BASICS OF MEMS	**(9)**
Micro electromechanical systems, devices and structures Definitions, Materials for MEMS: Silicon, silicon compounds, polymers, metals.	
UNIT III – MEMS FABRICATION TECHNOLOGIES	**(9)**
Microsystem fabrication processes: clean room standards, Semiconductor wafer cleaning, Photolithography, Ion Implantation, Diffusion and Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining.	
UNIT IV – MICRO SENSORS	**(9)**
Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors.	
UNIT V – MICRO ACTUATORS	**(9)**
Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. J. 1 Marc Madou, "Fundamentals of Microfabrication", CRC press 1997.
2. Stephen D. Senturia," Micro system Design", Kluwer Academic Publishers,2001

REFERENCES:

1. Ran Hsu,"MEMS and Microsystems Design and Manufacture", Tata Mcraw Hill, 2002.
2. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006

17ECM07 – AN INTRODUCTION TO ELECTRONIC SYSTEM PACKAGING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To know the basics of electronic system packing hierarchy.	**1.1**	The students will be able to apply the packaging hierarchy of electronic systems.	**a,b,c**
2.0	To learn the design methods of PCB fabrication.	**2.1**	The students will be able to design and manufacturing of printed circuit boards.	**a,b,c**
3.0	To understand the design rules to overcome EMI.	**3.1**	The students will be able to analyze the component packages available for a given application.	**a,b,c,d**
4.0	To learn the PCB assembly and soldering techniques.	**4.1**	The students will be able to apply the PCB assembly and soldering techniques.	**a,b,c,d**
5.0	To understand the fundamentals and standards of industrial design of electronic products.	**5.1**	The students will be able to design of product ergonomics and aesthetics.	**a,b,c**

UNIT I – PACKAGING OF ELECTRONIC SYSTEMS	**(9)**
Electronic systems and needs. Physical integration of circuits, packages, boards and full electronic systems, Connectivity in Electronic equipment, Study of Electronic components and its packaging. Package classifications (Through hole and SMDs) and packaging trends. Standards of packaging, Packaging hierarchy of Electronic Products and Systems, Hierarchy of Interconnection Levels.	
UNIT II - MANUFACTURING AND DESIGN OF SECOND LEVEL (PCB) BOARDS AND FABRICATION METHOD	**(9)**
Evolutions of Printed Circuit Boards, Classification of Printed Circuit Boards(Single Sided PC Boards, Double Sided PC Boards, Multilayer PC Boards) ,Challenges in Modern PCB Design and Manufacture, Major Market Drivers for PCB Industry, PCB for Electronic Systems. PCB design considerations/ design rules for analog, digital and power applications.	
UNIT III – ELECTROMAGNETIC COMPATIBILITY	**(9)**
Electromagnetic interference in electronic systems and its impact, Analysis of electronic circuit from noise emission point of view (both conducted and radiated emission) cross talk and reflection. Design rules to overcome EMI.	
UNIT IV – THERMAL DESIGN OF CHIPS AND BOARDS	**(9)**
Thermal management of electronic devices and systems, Overview. Thermal interface material. Heat density in electronic components, Heat transfer through conduction, convection and radiation, Heat sinks, Principle, Construction and materials. Performance, Method of cooling, Heat pipes, Peltier cooling plates. Recent developments, Application in Electronics Systems, Personal Computers, Batteries and Soldering.	
UNIT V - INDUSTRIAL DESIGN OF ELECTRONIC PRODUCTS	**(9)**
Fundamentals of Industrial Design, Industrial Design Process - Investigation of customer needs, Conceptualization, Preliminary refinement, Further refinement and final concept selection, Ergonomics, Aesthetics-Colour, Form, Type, Concurrent Engineering, Physical Design of Packaging Standards, Materials, Manufacturing, Rapid Prototyping.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS: 1. Rao R. Tummala, Fundamentals of Microsystems Packaging, McGraw Hill, NY, 2001.
REFERENCES: 1. William D. Brown, Advanced Electronic Packaging, IEEE Press, 1999.

17ECM08 – SYSTEM ON A CHIP DESIGN					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To know the basics of SOC design.	**1.1**	The students will be able to select the required processor for different applications.	**a,b,c**	
2.0	To learn the architecture and topology of system level interconnection.	**2.1**	The students will be able to interconnect different buses and interfaces.	**a,b,f**	
3.0	To understand the concept of codesign and modeling.	**3.1**	The students will be able to model an SOC using Codesign concepts.	**b,c,d,g,h**	
4.0	To learn the tools for implementation of SOC.	**4.1**	The students will be able to implement SOC using RTOS	**a,b,c,j,k,l**	
5.0	To understand the concepts testing in SOC.	**5.1**	The students will be able to validate the designed SOC.	**a,b,d,g,i,j,l**	

UNIT I – SOC INTRODUCTION	**(9)**
Driving Forces for SoC- Components - Generic template- Design flow- Hardware/Software nature, Design Trade-Offs-Major Applications-SYSTEM-LEVEL DESIGN: Processor selection-Concepts in Processor Architecture: Instruction set architecture (ISA) -Robust processors: Vector processor, VLIW, Superscalar, CISC, RISC—Processor evolution: Soft and Firm processors, Custom-Designed processors-IP based design- on-chip memory.	
UNIT II - SYSTEM-LEVEL INTERCONNECTION	**(9)**
On-chip Buses: basic architecture, topologies, arbitration and protocols, Bus standards: AMBA, Core Connect, Wishbone, Avalon-Network-on-chip: Architecture-topologies-switching strategies- routing algorithms-flow control, quality-of-service-Re-configurability in communication architectures.	
UNIT III – CO-DESIGN CONCEPTS	**(9)**
Nature of hardware & software- quest for energy efficiency- driving factors for hardware- software codesign- Codesign space-Dualism of Hardware design and Software design-Modeling Abstraction Level-Concurrency and Parallelism-Hardware Software tradeoffs- Introducing Dataflow modelling.	
UNIT IV – SOC IMPLEMENTATION	**(9)**
Study of Microblaze RISC processor - Real-time operating system (RTOS), peripheral interface and components, High-density FPGAs-Introduction to tools used for SOC design: Xilinx SoC based development kit.	
UNIT V - SOC TESTING	**(9)**
Manufacturing test of SoC: Core layer, system layer, application layer-P1500 Wrapper Standardization-SoC Test Automation (STAT).	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Michael J.Flynn, Wayne Luk , "Computer system Design: System-on-Chip", Wiley-India, 2012.
2. Sudeep Pasricha, Nikil Dutt , "On Chip Communication Architectures: System on Chip Interconnect", Morghan Kaufmann Publishers, 2008.

REFERENCES:

1. W.H.Wolf , "Computers as Components: Principles of Embedded Computing System Design", Elsevier, 2008.
2. Patrick Schaumont , "A Practical Introduction to Hardware/Software Co-design", 2nd Edition, Springer, 2012.

17ITX37 PROBLEM SOLVING USING JAVA					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program outcome**	
1.0	To understand the basics of Java Programming Language	**1.1**	The Students will be able to solve simple problems using Java.	**a,b,c,d,e, h,j,k,l**	
2.0	To understand fundamentals of programming such as conditional and iterative execution	**2.1**	The students will be able to write programs using branching and looping statements	**a,b,c,d,e, h,i,j,k,l**	
3.0	To understand the concepts of Java arrays and Strings.	**3.1**	The students will be able to Be able to develop confidently with Strings and implement arrays.	**a,b,c,d,e, h,i,j,k,l**	
4.0	To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods.	**4.1**	The students will be able to understand basic oops concepts and develop applications using inheritance and interfaces.	**a,b,c,d,e, h,i,j,k,l**	
5.0	To understand threads and collection concepts	**5.1**	The students will be able to build applications using threads and collection framework.	**a,b,c,d,e, h,i,j,k,l**	

UNIT I - INTRODUCTION TO JAVA	(9)
History of java-Features-Glimpse of java-Data types and Variables-Local variable-Instance variable-static variable-Keywords: this, super, final- Type conversion & casting- Importance of Scanner class-Getting started with Eclipse IDE and VSCode.	
UNIT II-OPERATORS AND DECISION MAKING STATEMENTS	(9)
Operators- Arithmetic Operator, Bitwise Operator, Conditional Operator, Unary Operator-Relational and Logical operators-Conditional statements: If else, If else if, Nested if -Looping Statements: For Loop, while Loop, do while loop-switch-break-continue- auto boxing and unboxing**.**	
UNIT III-ARRAYS AND STRINGS	(9)
Arrays: One Dimensional Array-Two Dimensional Array-Inbuilt functions in arrays. Strings-String array-Inbuilt functions in Strings-String Buffer class-String Builder class-String Tokenizer class	
UNIT IV-OBJECT-ORIENTED PROGRAMMING PARADIGM	(9)
Class-objects-Encapsulation-Inheritance and its types-Polymorphism: Static binding and dynamic binding-Methods –Constructors and its types-Abstract class-Interface.	
UNIT V- MULTITHREADING AND COLLECTIONS	(9)
Throwable classes-Exception types-Exception keywords-Collection classes: List, Set-Thread-Ways of thread creation-methods-thread priorities-Synchronization-multithreading-Lambda Expression.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Herbert Schildt, “Java:The Complete Reference”,McGraw Hill Education, Twelfth edition,2021.

REFERENCE:

1. Cay.S.Horstmann,GaryCornell, “Core Java-JAVA Fundamentals”, Prentice Hall,Eleventh edition, 2020.