SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR–440013

An Institute with Empowered Autonomy status
Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University,
Nagpur, Maharashtra (INDIA)

PROGRAMME SCHEME & SYLLABI

as per National Education Policy (NEP)

(With effect from Academic Year 2023-24)

B. Tech.

(ELECTRONICS AND COMMUNICATION ENGINEERING)

Department Vision:

Pursue excellence in Electronics and Communication Engineering through quality education, research and innovation contributing to the emerging technologies to serve industry and society

Department Mission:

- M1: Provide stimulating environment for learning and imparting quality technical education for solving real life problems.
- M2: Foster research and innovation ecosystem in the field of Electronics and Communication Engineering.
- M3: Inculcate technical capabilities, professional ethics and values to address the needs of industry and society.

Program Educational Objectives:

After graduation, graduates of Electronics & Communication Engineering will demonstrate ability to:

1. Exhibit effective communication, teamwork, multidisciplinary-approach, and ability to relate engineering issues in broader social context.
2. Engage in career enhancement through lifelong learning, research, higher studies and entrepreneurship to adapt to the changing professional and social needs.
3. Solve real life engineering problems by applying the knowledge of Electronics and Communication Engineering.

Program Outcomes:

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of Mathematics, Science, Engineering fundamentals, and engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, Formulate, Review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design / development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.
4. **Conduct investigation of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select and apply appropriate techniques resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentations, make effective presentations, and give and receive clear instructions.
11. **Project management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team to manage projects and in multidisciplinary environment.
12. **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes:

The Graduates of Electronics & Communication will be able to:

1. Apply electronic principles to analyze and interconnect functional blocks of analog & digital electronics and communication systems.
2. Select and apply appropriate technologies for simulation, design, and implementation and performance evaluation of hardware and software prototypes for electronics and communication systems.
3. Implement effective and appropriate interdisciplinary solutions including electronics and communication, for research, industrial and societal problems.

Scheme of Teaching & Examination of Bachelor of Technology
(Electronics and Communication Engineering)

Semester I

Sr. No.	Course Type	Code	Course	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	BSC	PHT1003	Semiconductor Physics	2	1	0	3	50	50	100	3
2	BSC	PHP1003	Semiconductor Physics Lab	0	0	2	1	50	0	50	0
3	BSC	MAT1001	Applied Mathematics I	2	1	0	3	50	50	100	3
4	BSC	MAP1001	Computational Mathematics Lab	0	0	2	1	50	0	50	0
5	ESC	EET1004	Basic Electrical Engineering	2	0	0	2	50	50	100	2
6	PCC	ECT1001	Digital Circuits and Fundamentals of Microprocessor	3	0	0	3	50	50	100	3
7	PCC	ECP1001	Digital Circuits and Fundamentals of Microprocessor Lab	0	0	2	1	50	0	50	0
8	ESC	ECT1002	Programming for Problem Solving	2	0	0	2	50	50	100	2
9	ESC	ECP1002	Programming for Problem Solving Lab	0	0	2	1	50	0	50	0
10	AEC	HUT1002	English for Professional Communication	2	0	0	2	50	50	100	2
11	AEC	HUP1002	English for Professional Communication Lab	0	0	2	1	50	0	50	0
12	CCA	HUP0001/ PEP0001/ CHP0001	Liberal/Performing Art Lab basket	0	0	2	1	50	0	50	0
13	VEC	HUT1004	Foundational course in Universal Human Value	1	0	0	1	50	0	50	0
			TOTAL	**14**	**2**	**12**	**22**				

Liberal/Performing Art Lab basket		
Sr. No.	**Course Code**	**Course Name**
1	HUP0001-1	Fundamentals of Indian Classical Dance: Bharatnatayam
2	HUP0001-2	Fundamentals of Indian Classical Dance: Kathak
3	HUP0001-3	Introduction to Digital Photography
4	HUP0001-4	Introduction to Japanese Language and Culture
5	HUP0001-5	Art of Theatre
6	HUP0001-6	Introduction to French Language
7	HUP0001-7	Introduction to Spanish Language
8	HUP0001-8	Art of Painting
9	HUP0001-9	Art of Drawing
10	HUP0001-10	Nature camp
11	PEP0001-21	Disaster Management through Adventure Sports
12	PEP0001-22	Self-defense Essentials and Basic Knowledge of Defense forces
13	CHP0001-31	Art of Indian traditional cuisine
14	CHP0001 -32	Remedies by Ayurveda

Scheme of Teaching & Examination of Bachelor of Technology

(Electronics and Communication Engineering)

Semester II

Sr. No.	Course Type	Course Code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	BSC	CHT2002	Chemistry of Functional Materials	2	0	0	2	50	50	100	2
2	BSC	CHP2002	Chemistry of Functional Materials Lab	0	0	2	1	50	0	50	0
3	BSC	MAT2001	Applied Mathematics II	2	1	0	3	50	50	100	3
4	ESC	ECT2001	Network Theory	3	0	0	3	50	50	100	3
5	PCC	ECT2002	Electronic Devices	3	0	0	3	50	50	100	3
6	PCC	ECP2002	Electronic Devices Lab	0	0	2	1	50	0	50	0
7	VSEC	ECT2003	Object Oriented Programming	3	0	0	3	50	50	100	3
8	VSEC	ECP2003	Object Oriented Programming Lab	0	0	2	1	50	0	50	0
9	ESC	ECP2004	Computer Workshop Lab	0	0	2	1	50	0	50	0
10	IKS	HUT2001	Foundational Literature of Indian Civilization	2	0	0	2	50	50	100	2
11	CCA	PET2001	Sports-Yoga-Recreation	1	0	0	1	50	0	50	0
12	CCA	PEP2001	Sports-Yoga-Recreation Lab	0	0	2	1	50	0	50	0
			TOTAL	**16**	**1**	**10**	**22**				

Exit option 1
(Additional 8 Credits)
Offline/Online (ESSC-India / NSQF skill) Certification Course on – Assembly & Maintenance of Personal Computer / Electronics Servicing and Maintenance or similar course, approved by the BoS. **OR** Technical Project **OR** One Month Internship at Industry

Scheme of Teaching & Examination of Bachelor of Technology
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Semester III

Sr. No	Course Type	Course Code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	PCC	ECT3001	Electronic Circuits	3	0	0	3	50	50	100	3
2	PCC	ECP3001	Electronic Circuits Lab	0	0	2	1	50	0	50	0
3	PCC	ECT3002	Analog Circuits Design	3	0	0	3	50	50	100	3
4	PCC	ECP3002	Analog Circuits Design Lab	0	0	2	1	50	0	50	0
5	PCC	ECT3003	Digital system Design with HDL	3	0	0	3	50	50	100	3
6	PCC	ECP3003	Digital system Design with HDL Lab	0	0	2	1	50	0	50	0
7	PCC	ECT3004	Signals and Systems	2	1	0	3	50	50	100	3
8	OE	ECT2980	Open Elective - 1	2	0	0	2	50	50	100	3
9	MDM	MAT3004	Applied Mathematics – III	2	1	0	3	50	50	100	3
10	VEC	CHT3001	Environmental Science	2	0	0	2	50	50	100	2
			TOTAL	**18**	**3**	**6**	**22**				

Open Elective - I	
Course Code	**Course Name**
ECT2980 – 1	Microsoft Azure Cloud Services
ECT2980 – 2	Solar Cells

Scheme of Teaching & Examination of Bachelor of Technology
(Electronics and Communication Engineering)
Semester IV

Sr. No.	Course Type	Course Code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	PCC	ECT4001	Electromagnetic Fields	2	1	0	3	50	50	100	3
2	PCC	ECT4002	Analog and Digital Communication	3	0	0	3	50	50	100	3
3	PCC	ECP4002	Analog and Digital Communication Lab	0	0	2	1	50	0	50	0
4	PCC	ECT4003	Microcontrollers & Peripherals	3	0	0	3	50	50	100	3
5	PCC	ECP4003	Microcontrollers & Peripherals Lab	0	0	2	1	50	0	50	0
6	MDM	ECT4004	Data Structures and Algorithms	2	0	0	2	50	50	100	2
7	MDM	ECP4004	Data Structures and Algorithms Lab	0	0	2	1	50	0	50	0
8	OE	ECT2990	Open Elective - 2	2	1	0	3	50	50	100	2
9	VSEC	ECP4005	Electronic Measurements & Instrumentation Lab	0	0	2	1	50	0	50	0
10	CEA	ECP4006	Co curricula Activities/ Community/Field Project	0	0	4	2	50	0	50	0
11	AEC	HUT4001	Business Communication	2	0	0	2	50	50	100	2
			TOTAL	**14**	**1**	**8**	**22**				

Open Elective - II	
Course Code	**Course Name**
ECT2990 – 1	Machine Learning and Robotics on AWS
ECT2990 – 2	Solar Energy system Design

Exit option 2(Additional 8 Credits)

Offline/Online (ESSC-India / NSQF skill) Course on –
Microprocessors/Microcontrollers based Product Design / PCB Design and Circuit Simulation or similar course, approved by the BoS
OR
Technical Project
OR
One Month Internship at Industry

Scheme of Teaching & Examination of Bachelor of Technology
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Semester V

Sr. No.	Course Type	Course Code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Conti-nous Evaluation	End Sem Exam	Total	
1	PCC	ECT5001	Probability Theory and Stochastic Processes	3	0	0	3	50	50	100	3
2	PCC	ECT5002	Digital Signal Processing	3	0	0	3	50	50	100	3
3	PCC	ECP5002	Digital Signal Processing Lab	0	0	2	1	50	0	50	0
4	PCC	ECT5003	VLSI Design	3	0	0	3	50	50	100	3
5	PCC	ECP5003	VLSI Design Lab	0	0	2	1	50	0	50	0
6	MDM	ECT5004	Computer Architecture and Organization	2	0	0	2	50	50	100	2
7	MDM	ECP5004	Computer Architecture and Organization Lab	0	0	2	1	50	0	50	0
8	VSEC	ECP5005	Electronic Design Workshop	0	0	2	1	50	50	100	2
9	PEC	ECT5006	Program Elective 1	3	0	0	3	50	50	100	3
10	OE	ECT3980	Open Elective 3	2	1	0	3	50	50	100	2
			TOTAL	**16**	**0**	**8**	**21**				

Program Elective -1	
Course Code	**Course Name**
ECT5006 – 1	Information Theory and Coding
ECT5006 – 2	Smart Sensors
ECT5006 – 3	MEMS and NEMS

Open Elective - III	
Course Code	**Course Name**
ECT3980 – 1	Architecting Solutions on AWS

Scheme of Teaching & Examination of Bachelor of Technology
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Semester VI

Sr. No.	Course Type	Course Code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Conti-nous Evaluation	End Sem Exam	Total	
1	PCC	ECT6001	Embedded Systems	3	0	0	3	50	50	100	3
2	PCC	ECP6001	Embedded Systems Lab	0	0	2	1	50	0	50	0
3	PCC	ECT6002	Waveguides and Antennas	3	0	0	3	50	50	100	3
4	PCC	ECP6002	Waveguides and Antennas Lab	0	0	2	1	50	0	50	0
5	PCC	ECT6003	Wireless Communication	3	0	0	3	50	50	100	3
6	MDM	ECT6004	Data Base Management Systems	2	0	0	2	50	50	100	2
7	MDM	ECP6004	Data Base Management Systems Lab	0	0	2	1	50	0	50	0
8	PEC	ECT6005	Program Elective 2	3	0	0	3	50	50	100	3
9	PRJ	ECP6006	Major Project Phase I	0	0	4	2	50	50	100	2
10	HSSM	HUT6001	Engineering Economics	2	0	0	2	50	50	100	2
			TOTAL	**16**	**0**	**10**	**21**				

Program Elective - 2	
Course Code	**Course Name**
ECT6005 – 1	Speech and Audio Processing
ECT6005 – 2	Introduction to Internet of Things
ECT6005 – 3	System Verilog

Exit option 3
(Additional 8 Credits)
Offline/Online (ESSC-India / NSQF skill) Course on – PC Hardware and Computer networking / Embedded system design IoTor similar course, approved by the BoS **OR** Technical Project **OR** One Month Internship at Industry

Scheme of Teaching & Examination of Bachelor of Technology
(Electronics and Communication Engineering)
Semester VII

Sr. No.	Course Type	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration(Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	PCC	ECT7001	Computer Networks	3	0	0	3	50	50	100	3
2	PCC	ECP7001	Computer Networks Lab	0	0	2	1	50	0	50	0
3	PEC	ECT7002	Program Elective 3	3	0	0	3	50	50	100	3
3	PEC	ECT7003	Program Elective 4	3	0	0	3	50	50	100	3
4	PEC	ECT7004	Program Elective 5	3	0	0	3	50	50	100	3
5	ESC	ECT7005	Control Systems	3	0	0	3	50	50	100	3
6	MDM	ECT7006	System Software & Operating System	2	0	0	2	50	50	100	2
7	PRJ	ECP7007	Major Project Phase 2	0	0	4	2	50	50	100	2
			TOTAL	**17**	**0**	**6**	**20**				

Program Elective - 3	
Course Code	**Course Name**
ECT7002– 1	Microwave Theory & Techniques
ECT7002– 2	Unmanned Aerial Systems
ECT7002– 3	VLSI Technology

Program Elective - 4	
Course Code	**Course Name**
ECT7003– 1	Smart Antennas
ECT7003– 2	Artificial Intelligence
ECT7003– 3	Fundamentals of Physical Design

Program Elective - 5	
Course Code	**Course Name**
ECT7004– 1	Optical and Satellite Communication
ECT7004– 2	Digital Image Processing
ECT7004– 3	VLSI Signal Processing

Scheme of Teaching & Examination of Bachelor of Technology
(Electronics and Communication Engineering)
Semester VIII

Sr. No	Course Type	Course Code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	PEC	ECT8001	Program Elective 6	3	0	0	3	50	50	100	3
2	PEC	ECT8002	Program Elective 7	3	0	0	3	50	50	100	3
3	PRJ	ECP8003	Project	0	0	12	6	50	50	100	3
			TOTAL	**6**	**0**	**12**	**12**				
			OR								
1	INT	ECP8004	Full Semester Industry Internship	**0**	**0**	**24**	**12**				

Program Elective - 6	
Course Code	**Course Name**
ECT8001 – 1	Wireless Sensor Networks
ECT8001 – 2	Deep Learning
ECT8001 – 3	Advanced Semiconductor Devices

Program Elective - 7	
Course Code	**Course Name**
ECT8002 – 1	5G and Next Generation Communication Systems
ECT8002 – 2	Networks and Systems Security
ECT8002 – 3	RF Circuit Design

Scheme of Teaching & Examination of Bachelor of Technology

(Electronics and Communication Engineering)

Semester VII and VIII with Full year Internship

Sr. No	Course Type	Course Code	CourseName	Hours/week		Credits	Maximummarks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PEC	ECT7008	MOOC-1	3	0	3	50	50	100	
2	PEC	ECT7009	MOOC-2	3		3	50	50	100	
3	PEC	ECT8005	MOOC-3	2	0	2	50	50	100	
4	INT	ECP8006	Full year Internship	**0**	**48**	**24**	200	200	400	**-**
			TOTAL			**32**				

Students are required to earn total **8 credits** through **NPTEL SWAYAM MOOC** platform by selecting the course(s) from the following list.

1.	Computer Networks
2.	Control Systems
3.	System Software & Operating System
4.	Microwave Theory & Techniques
5.	Unmanned Aerial Systems
6.	VLSI Technology
7.	Smart Antennas
8.	Artificial Intelligence
9.	Fundamentals of Physical Design
10.	Optical and Satellite Communication
11.	Digital Image Processing
12.	VLSI Signal Processing
13.	Wireless Sensor Networks
14.	Deep Learning
15.	Advanced Semiconductor Devices
16.	5G and Next Generation Communication Systems
17.	Networks and Systems Security
18.	RF Circuit Design

Scheme of B. Tech. in Electronics and Communication Engineering– HONORS

Sem	Course Code	Name	L	T	P	Cr	Continuous Assessment	ESE	Total	ESE Duration
III	ECTH3100	Communication System Analysis	3	0	0	3	50	50	100	3
IV	ECTH4100	Multimedia Networks	3	0	0	3	50	50	100	3
V	ECTH5100	Cryptography and Information Security	4	0	0	4	50	50	100	3
VI	ECTH6100	Evolution of Air Interface towards 5G	4	0	0	4	50	50	100	3
VII	ECPH7100	Project	0	0	8	4	50	50	100	3
		TOTAL	**14**	**0**	**8**	**18**				

Scheme of B. Tech. in Electronics and Communication Engineering – HONORS with RESEARCH

Sem	Course Code	Name	L	T	P	Cr	Continuous Assessment	ESE	Total	ESE Duration
VII	ECTR7100	Research Methodology	3	0	0	3	50	50	100	3
VII	ECPR7100	Research Project Phase – I	0	0	6	3	50	50	100	-
VIII	ECPR8100	Research Project Phase – II	0	0	24	12	50	50	100	-
		TOTAL	**3**	**0**	**30**	**18**				

Scheme of B. Tech. in Electronics and Communication Engineering–MINOR

Sem	Code	Name of the course	L	T	P	Cr	Continuous Assessment	ESE	Total	ESE Duration
III	ECTM 3100	Fundamentals of Communication Engineering	3	0	0	3	50	50	100	3
IV	ECTM 4100	Sensors for Smart City	3	0	0	3	50	50	100	3
V	ECTM 5100	IoT for Industrial Application	4	0	0	4	50	50	100	3
VI	ECTM 6100	Future Generation Networks	4	0	0	4	50	50	100	3
VII	ECPM 7100	Project	0	0	8	4	50	50	100	3
		TOTAL	**14**	**0**	**8**	**18**				

I SEMESTER

SYLLABUS FOR SEMESTER I

Electronics & Communication Engineering,

Course Code: PHT1003 **Course: Semiconductor Physics**

L: 2 Hrs. T: 1 Hrs. P: 0 Hrs. per week **Total Credits: 3**

Course Objectives

1. To introduce ideas of quantum mechanics necessary to begin understanding semiconductor devices;

2. To familiarize prospective engineers with fundamental concepts of semiconductors and their interaction with light and resulting devices

Course Outcomes

On successful completion of the course, student will be able to

1: Outline the difference between intrinsic/extrinsic semiconductors and their carrier transport phenomena in semiconductor.

2: Illustrate the working and design aspects for the various photonic devices like LEDs, solar-cells and LASER diodes.

3: Classify materials on the basis of band theory and its importance for semiconductors.

4: Apply fundamental knowledge of quantum mechanics to examine electrons behavior in solids at the quantum level.

5: Analyze the process of generation and recombination of excess charge carriers in semiconductors along with working principle of P-N junction and Metal-Semiconductor junction diode

Course Content:

Unit 1: Introduction to Quantum Mechanics

Wave-particle duality, Heisenberg uncertainty relations, the quantum state wave function and its probability interpretation, Schrodinger's equation, Particle in an infinite potential well, Quantum tunneling,

Unit 2: Electronic Materials

Formation of energy bands in solids, Classification of electronic materials, Kronig-Penny model, E-k diagram, Direct and indirect bandgaps, Valence and conduction bands, Density of states, Fermi-Dirac statistics, Fermi level, Effective mass.

Unit 3: Intrinsic and Extrinsic Semiconductors

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature, Carrier transport: diffusion and drift

Unit 4: Non-Equilibrium Semiconductors

Carrier generation and recombination, Continuity equation, Ambipolar transport equation, Quasi-Fermi Energy levels, Excess Carrier Lifetime, Qualitative introduction to recombination mechanisms.

Unit 5: Junction Physics

p-n junction diode, Zero-applied bias, forward bias, reverse bias, Application of diode as a rectifier, Zener diode, Special diodes: Tunnel diode, Schottky diode, Ohmic contacts, NPN and PNP transistor &its characteristics, Configurations.

Unit 6: Optoelectronic Devices

Optical absorption in semiconductors**,** Light emitting diodes, Laser diode, Stimulated emission and photon amplification, Einstein Coefficients, Solar Energy Spectrum, Solar Cells.

Text Book(s):

1. Semiconductor Physics and Devices (Fourth Edition), Donald A. Neamen, McGraw-Hill 2012.
2. Semiconductor Device Physics and Design, Umesh K Mishra and Jasprit Singh, Springer 2008.
3. Electronic Devices and Circuits, Jacob Millman, Christos C. Halkias, McGraw Hill 1967.

References:

1. Optoelectronics and Photonics: Principles and Practices by S. O. Kasap, Prentice Hall2001
2. Physics of Semiconductor Devices, Simon M. Sze, Wiley-Interscience (1981)

SYLLABUS FOR SEMESTER I

Electronics & Communication Engineering,

Course Code: PHP1003 **Course: Semiconductor Physics Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. per week **Total Credits: 1**

Course Outcomes

At the end of the Course the students will learn to:

1: Develop skills required for experimentation and verification of physics laws.

2: Analyse the results obtained through proper graph plotting and Error analysis.

3: Conduct experiments to validate physical behavior of materials/components.

4: Analyze the behavior and characteristics of P-N Junction, Zener-Diode and other semiconductor devices.

5: Prepare laboratory reports on interpretation of experimental results

List of Experiments:

1. Parameter extraction from V-I characteristics of a diode
2. Parameter extraction from V-I characteristics of a transistor
3. Analysis of diode rectifier
4. Resistivity measurement of semiconductor by Four Probe method
5. Performance and analysis of Hall Effect in semiconductor to determine the Hall coefficient and carrier concentration of the majority carriers in the given specimen
6. Estimation of energy gap in semiconductor
7. Characteristics and analysis of solar cells
8. Verification of Ohm's law and error analysis of the data using Linear Least Square Fit (LLSF) method
9. Analysis of energy values and wave function using Mathematica software
10. Verification of Planck's constant

Reference:

1. Laboratory manual of the Physics Department
2. Principles and Practices by S. O. Kasap, Prentice Hall2001

B. Tech Semester I

(For Electronics & Communication Engineering, Electronics & Computer Science Engineering , Electrical Engineering, Civil Engineering , Mechanical Engineering , Biomedical Engineering)

Course Code: MAT1001 **Course Name: Applied Mathematics I**

L: 2Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 03**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in Ordinary differential equation, statistics, probability and differential calculus.
It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes:

On successful completion of the course, the students will able to:

1. Recognize first order ordinary differential equations that can be solved by each of the four methods – Linear DE, exact DE, reducible to linear DE and reducible to exact differential equations and use the appropriate method to solve them.
2. Solve higher order ordinary differential equations with constant and variable coefficients.
3. Find best fit curve by method of least square method and calculate correlation, regressions.
4. Recognize and understand discrete, continuous probability distributions and apply Binomial distribution, Poisson distribution and Normal distribution to appropriate problems.
5. Internalize multivariable calculus and apply it find Jacobians, maxima and minima of function.
6. Solve numerical integrations by Newton coat formulas and Gauss-Legendre Quadrature.

Course Content:

Module 1: First order ordinary differential equations(7 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut'stype, Applications of First order Differential Equations.

Module 2: Ordinary differential equations of higher orders (8 hours)

Second order linear differential equations with constant and variable coefficients, method of variation of parameters, Cauchy-Euler equation. Applications of Higher order Differential Equations.

Module 3: Statistics: (7 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves, correlation and regression – Rank correlation, Multiple regression and correlation and its application in Engineering.

Module 4: Differential Calculus (10 hours**)**

Taylor's and Maclaurin's series expansions, radius of curvature (Cartesian form), evolutes and involutes, Limit and continuity of functions of several variables and their partial derivatives, Euler's Theorem, chain rule, total derivative, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers.

Module 5: Probability: (8 hours)(**For All Branches except Mechanical Branch**)

Probability spaces, conditional probability, independence, Bay's Theorem, Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution. Relation between binomial, Poisson and Normal distributions.

OR

Module 5: Numerical Integration (8 hours**)** (**Only for Mechanical Branch**)

Simpson's 1/3rd rule, 3/8th rule, Trapezoidal rule, Gauss-Legendre Quadrature.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Theory and Problems of probability and statistics : 2nd ed :J. R. Spiegal ,Schaum series
8. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune VidhyarthiGrihaPrakashan, Pune-411030 (India).
9. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

B. Tech Semester I

(For Electronics & Communication Engineering, Electronics & Computer Science Engineering , Electrical Engineering, Civil Engineering , Mechanical Engineering)

Course Code: MAP1001 **Course: Computational Mathematics Lab**

L: 0 Hr., T: 0 Hr., P: 2 Hrs., Per week **Total Credits:1**

Course Objectives:

The computational Mathematics Lab course will consist of experiments demonstrating the principles of Mathematics relevant to the study of Science and Engineering. Students will show that they have learnt Laboratory skills that will enable them to properly acquire and analyze the data in the lab and draw valid conclusions. On successful completion of the course students shall be able to:

Course Outcomes:

By using open source software SageMath Students will be able to

CO1: Download SageMath and use it as an advance calculator.

CO2: Sketch and analyze function graphs.

CO3: Apply the concepts of differential calculus to find extreme value of continuous functions and analyze solutions of differential equations

CO4: Evaluate improper integrals and its applications to find length, area, volume, centre of gravity and mass.

CO5: Analyze and calculate eigen values, eigen vectors, rank nullity, and solve system of linear equations of a matrix / linear map.

CO6: Analyze the data to find best fit curve.

Mapping of Course outcomes (COs) with Experiments

Exp. No.	Name of Experiments	Mapped COs
1	To use SageMath as advanced calculator	CO1
2	2D Plotting with SageMath	CO2
3	3D Plotting with SageMath	CO2
4	Differential Calculus with SageMath	CO3
5	Solution of differential equations in SageMath	CO3
6	Basics of Linear Algebra	CO5
7	Curve Fitting by using SageMath	CO6
8	Integral Calculus with SageMath	CO4

Syllabus for Semester I, B.Tech. (Electronics and Communication Engineering)

Course Code: EET1004 **Course: Basic Electrical Engineering**
L: 2 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 02**

Course Objectives

The objective of the course is to make the studentsfamiliar with basic concepts of electrical engineering, transformer and rotating electrical machines.

Course Outcomes

At the end of this course, students will be able to

1. Apply the concept of basic laws for solving the DC circuits.
2. Analyse the behaviour of single phase and three phase AC circuits.
3. Discuss the working principle of transformer and calculate its parameters.
4. Comprehend the working of Induction motors and BLDC motor.

Course Content:

Module I: (6 Hours)

DC Circuits: circuit elements resistor, inductor and capacitor, Ohm's Law and Kirchhoff's Laws; Analysis of series, parallel circuits excited by independent voltage sources; energy sources, dependent sources, star- delta transformation.

Module II: (8 Hours)

A.C. Circuits: Generation of sinusoidal voltage, basic terminologies associated with AC quantity, phasor representation of alternating quantities, Real power, reactive power, apparent power and power factor, Analysis of basic series and parallel AC circuit.

Three Phase A.C. Circuits: Basic concepts; Relationship between line and phase values of balanced star and delta connections; Power in balanced three phase circuits.

Module III: (8 Hours)

Transformers: Basic principle and construction of single-phase transformer; Operation under no load and load condition, equivalent circuit, voltage regulation and efficiency.

Module IV: (6 Hours)

Induction Motors: Construction, working principle and applications of single-phase motors. Working principle of three phase induction motor; Introduction to BLDC motors: working principle, construction with its applications.

TEXT/REFERENCS BOOKS:

1. Kulshreshtha D.C. (2009), Basic Electrical Engineering, Tata McGraw Hill.
2. Electrical Technology: B. L. Thareja, S. Chand Publications.
3. Basic Electrical Engineering: S. B. Bodkhe, N. M. Deshkar, P.P.H. Pvt. Ltd.

4. Nagrath I.J. and D. P. Kothari (2001), Basic Electrical Engineering, Tata McGraw Hill
5. AICTE's Prescribed Textbook: Basic Electrical Engineering, Khanna Book Publishing.

Syllabus for Semester I, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT1001 **Course: Digital Circuits and Fundamental of Microprocessors**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Objectives

1. To acquire knowledge of various logic families of Digital Circuits and understand basic concepts of Digital Systems.
2. To understand Hardware Implementation of design circuits and determine the output and performance of given combinational circuits.
3. To make student aware of microprocessors and will impart the concept of assembly programming.
4. To make student aware of hardware interfaces needed to develop a microcomputer system.

Course Outcomes

On completion of this course students will be able to:

1. Identify the logic families and understand the requirements of digital logic design.
2. Implement logic circuits using Boolean algebra.
3. Apply knowledge of digital circuits to different types of arithmetic and combinational circuits.
4. Evaluate ALU design for microprocessor and infer its programming needs in terms of architecture.
5. Construct a microprocessor circuit and demonstrate interfacing requirements of microprocessor.

Course Content:

Unit I Logic families (TTL, ECL) and their characteristics – Fan-In, Fan-Out, Propagation Delay, Power dissipation, Noise Margin, Timing issues, Comparison of different logic families.

Unit II Analog v/s Digital systems, Number Systems, Boolean algebra, Boolean identities, Digital Codes – Binary, Gray, Hex, ASCII, BCD, Self Complimentary, Conversion, D Morgan's laws, SOP, POS, representation of signed numbers, Logic Gates, Implementation of Boolean expression using logic gates, Karnaugh Map, simplification and Implementation using K-Maps.

Unit III Combinational circuits – Decoders, Encoders, Multiplexers, Demultiplexers, Adders, Subtractors, and ALU.

Unit IV Introduction to Intel's 8086 Architecture and its description along with functional pin diagram, organization of Memory in microcomputer system. Flag structure, Addressing

Modes & Instruction set of 8086.

Unit V Assembly language Programming and timing diagram of instructions. Concept of Interrupts and its structure in 8086 & Interrupt service routines. Min/Max mode of 8086

Text books:

1. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989
2. K M Bhurchandi, A K Ray, Advanced microprocessors and Peripherals, McGraw Hill Education India, 2012, 3rd ed.

Reference Books:

1. R.P.Jain,"ModerndigitalElectronics",TataMcGrawHill,4thedition,2009.
2. Morris Mano and Michael Ciletti,"Digital Design: With an Introduction to Verilog HDL", 5e, 2011

Syllabus for Semester I, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP1001 **Course: Digital Circuits and Fundamental of Microprocessors Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course Objectives

1. To acquire knowledge of various logic families of Digital Circuits and understand basic concepts of Digital Systems.
2. To understand Hardware Implementation of design circuits and determine the output and performance of given combinational circuits.
3. This course will make student aware of microprocessors and will impart the concept of assembly programming.
4. This course will make student aware of hardware interfaces needed to develop a microcomputer system.

Course outcomes

On completion of this course students will be able to:

1. Understand digital circuits requirements for logic design.
2. Implement logic circuits using Boolean algebra.
3. Apply knowledge of digital circuits to different types of arithmetic and combinational circuits.
4. Validate assembly language programming for microprocessor.
5. Construct a microprocessor circuit and demonstrate interfacing requirements of microprocessor.

Experiments based on:

1. Boolean Equations and Gate IC's.
2. Combinational circuits.
3. Assembly language programs based on logical and arithmetic instructions with microprocessor.
4. Assembly language programs based on hardware interface modules with microprocessor.

Syllabus for Semester I, B. Tech (Electronics and Communication Engineering)

Course Code: ECT1002 **Course: Programming for Problem Solving**
L: 2 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 02**

Course Objectives

The objective of the course is to prepare the students:

1. To choose a suitable C-construct and recognize the bugs to develop C code.
2. To develop C programs by illustrating the applications of different data types such as arrays, pointers, functions to solve various problems.

Course outcomes

At the end of this course students will demonstrate the ability to:

1. Understand fundamentals of algorithms, Flowchart, Pseudo code and C language
2. Identify correctness in syntax and logic for the program which is developed from algorithm.
3. Use arrays, pointers, structures and I/O operations for the formulation of algorithms and programs.
4. Apply programming to solve matrix addition, multiplication problems and searching & sorting problems.
5. Implement conditional branching, iteration and recursion, to decompose a problem into functions and synthesize a complete program using divide and conquer approach.

Course Content:

Unit I: Introduction to Programming: – Algorithm building, Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. Introduction to C language: Comments, Header files, Keywords, Constant, Variable, data types, constants and variables, operators, Types of Statements, Pre-processor Directives. Control statements, Looping statements and Nesting of control structures.

Unit II: Arrays and Functions: - Concepts of array, one- and two-dimensional arrays, declaration and initialization of arrays for algorithm building. User defined and Library Functions, Parameter passing in functions, call by value, passing arrays to functions, call by reference, Difference between functions and recursion.

Unit III: Pointers and Structures: - Basics of pointers, pointer to pointer, pointer and array, pointer to array, array to pointer, function returning pointer. Basics of structure, structure members, accessing structure members, nested structures, array of structures, structure and functions, structures and pointers.

Unit IV: File handling: - Streams in C, Types of Files, File Input/output Operations: Modes of file opening, Reading and writing the file, Closing the files.

Text Books:

1. Programming in ANSIC: E. Balguruswami Mc-Graw Hill
2. Mastering C: K. R. Venugopal and S. R. Prasad, Tata Mc-Graw Hill

Reference Books:

1. Programming with C: Byron Gottfried, Schaums Outline Series.
2. Let Us C: Yashwant Kanetkar, B P B Publication

Syllabus for Semester I, B. Tech (Electronics and Communication Engineering)

Course Code: ECP1002 Course: Programming for Problem Solving Lab.
L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week Total Credits: 01

Course Objectives

The objective of the course is to prepare the students:

1. To choose a suitable C-construct and recognize the bugs to develop C code.
2. To develop C programs by illustrating the applications of different data types such as arrays, pointers, functions to solve various problems.

Course outcomes

At the end of this course students will demonstrate the ability to:

1. Understand fundamentals of C language
2. Analyze correctness in syntax and logic for the program which is developed from algorithm.
3. Apply debugging techniques according to the algorithm requirements
4. Evaluate the computational resources for a program application
5. Implement conditional branching, iteration and recursion, to decompose a problem into functions and synthesize a complete program.

Experiments based on:

- Control statements, Looping statements and Nesting of control structures
- Arrays and Functions
- Pointers and Structures
- File handling

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code: HUT1002 Course: English for Professional Communication
L: 2 Hrs, T: 0 Hr, P: 0Hr, Per Week Total Credits: 2

Course Objectives

The main objective of this course is to enhance the employability skills of students as well as prepare them for effective work place communication.

Course Outcomes

On successful completion of the course the students will be able to achieve the following:

CO1. Demonstrate effective use of word power in written as well as oral communication.

CO2. Understand the techniques of listening and apply the techniques of reading comprehension used in professional communication.

CO3. Apply the principles of functional grammar in everyday as well as professional communication.

CO4. Effectively implement the comprehensive principles of written communication by applying various writing styles.

CO5. Create precise and accurate written communication products.

Course Content:

Unit-1: Vocabulary Building

1.1 Importance of using appropriate vocabulary

1.2 Techniques of vocabulary development

1.3 Commonly used power verbs, power adjectives and power adverbs.

1.4 Synonyms, antonyms, phrases & idioms, one-word substitutions and standard abbreviations

Unit -2: Listening and Reading Comprehension

2.1 Listening Comprehension: active listening, reasons for poor listening, traits of a good listener, and barriers to effective listening

2.2 Reading Comprehension: types and strategies.

Unit -3: Functional Grammar and Usage

3.1 Identifying Common Errors in use of: articles, prepositions, modifiers, modal auxiliaries, redundancies, and clichés

3.2 Tenses

3.3 Subject-verb agreement, noun-pronoun agreement

3.4 Voice

Unit-4: Writing Skills

4.1 Sentence Structures

4.2 Sentence Types

4.3 Paragraph Writing: Principles, Techniques, and Styles

Unit-5: Writing Practices

5.1 Art of Condensation: Précis, Summary, and Note Making

5.2 Correspondence writing techniques and etiquettes – academic writing

5.3 Essay Writing

Reference Books

1. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press.2011.

2. Practical English Usage. Michael Swan. OUP. 1995.

3. Remedial English Grammar. F.T. Wood. Macmillan.2007

4. On Writing Well. William Zinsser. Harper Resource Book. 2001

5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code: HUP1002 Course: English for Professional Communication Lab
L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week Total Credits: 1

Course Objective

To enhance competency of communication in English among learners

Course Outcomes

On completion of English Lab course, students will be able to achieve the following:

CO1: Apply effective listening and speaking skills in professional and everyday conversations.

CO2: Demonstrate the techniques of effective Presentation Skills

CO3: Evaluate and apply the effective strategies for Group Discussions

CO4: Analyze and apply the effective strategies for Personal Interviews

CO5: Implement essential language skills- listening, speaking, reading, and writing Syllabus

List of practicals:

Computer Assisted + Activity Based Language Learning

Practical 1: Everyday Situations: Conversations and Dialogues – Speaking Skills

Practical 2: Pronunciation, Intonation, Stress, and Rhythm

Practical 3: Everyday Situations: Conversations and Dialogues – Listening Skills

Activity Based Language Learning

Practical 4: Presentation Skills: Orientation & Mock Session

Practical 5: Presentation Skills: Practice

Practical 6: Group Discussions: Orientation & Mock Session

Practical 7: Group Discussions: Practice

Practical 8: Personal Interviews: Orientation & Mock Session

Practical 9: Personal Interviews: Practice

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-1	**Fundamentals of Indian Classical Dance: Bharatnatayam**	I/II	2	1	50

Course objective

The course aims to introduce the students to Bharatnatyam, an important element of Indian traditional knowledge system. The course will not only provide the learning and skill to perform this art but would also enhance many mental and physical aspects of the students such as strength, flexibility, discipline, self-confidence, creativity, focus, coordination, etc.

Course Outcomes

On completion of the course, students will be able to achieve the following:

CO1: Understand the importance of dance and Bharatnataym as an Indian dance formCO2: Develop skills to perform the dance form at its basic level.

CO3: Evaluate their strengths and interest to take bridge course to give *Pratham* (1st level formal exam of Bharatnatayam).

Syllabus

Practical -1: Orientation in Bharatnatayam

Practical-2: Tattu Adavu till 8, Naatta Adavu 4 Steps, Pakka Adavu 1 step, Metta Adavu 1 Step, Kuditta Metta Adavu 4 Steps,

Practical -3: Practice sessions

Practical-4: Tatta Kuditta Adavu (Metta), Tatta Kuditta Adavu (Metta) 2 Steps, Tirmanam Adavu 3 Steps, Kattu Adav - 3 Steps, Kattu Adav - 3 Steps

Practical-5: Practice sessions

Practical-6: Tiramanam (front) 3 Steps, Repeat of Tiramanam (Overhead) 3 Steps, Practical-7: practice sessions

Practical – 8: final practice sessions and performances.

Recommended reading

1. *Introduction to Bharata's Natyasastra*, Adya Rangacharya, 2011
2. *The Natyasastra and the Body in Performance: Essays on the Ancient Text*, edited by Sreenath Nair, 2015
3. *Bharatanatyam How to ... : A Step-by-step Approach to Learn the Classical Form*, Eshwar Jayalakshmi, 2011

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-2	**Fundamentals of Indian Classical Dance: Kathak**	I/II	2	1	50

Course objective

The course aims to introduce the students to Kathak, an important element of Indian traditional knowledge system. The course will not only provide the learning and skill to perform this art but would also enhance many mental and physical aspects of the students such as strength, flexibility, discipline, self-confidence, creativity, focus, coordination, etc.

Course Outcomes

On completion of the course, students will be able to achieve the following:

CO1: Understand the importance of dance and Kathak as an Indian dance form CO2: Develop skills to perform the dance form at its basic level.

CO3: Evaluate their strengths and interest to take bridge course to give *Prarambhik* (1st level formal exam of Kathak).

Syllabus

Practical -1: Orientation in Kathak. Correct posture of kathak, Basic Movements and exercise Stepping, Chakkar of 5 count (Bhramari),

Practical -2: practice sessions of practical 1

Practical -3: Hastaks, Hastaks and Steppings, Reciting asamyukta Mudra shloka, Hastak and steppings

Practical -4: practice sessions of practical 3

Practical -5: Todas and Asamyukta hasta mudra shlok, Vandana of Shlok, 2 Todas and Vandana, Ghante Ki Tihai,

Practical -6: practice sessions of practical 5

Practical -7: 2 1 Chakkardar Toda and Ginnti Ki Tihai, 2 Todas and 1 Chakkardar Toda, practice sessions

Practical -8: Final performances.

Recommended reading

1. Kathak Volume1 A "Theoretical & Practical Guide" (Kathak Dance Book), Marami Medhi & Debasish Talukdar, 2022, Anshika Publication (13 September 2022)

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-3	**Introduction to Digital Photography**	I/II	2	1	50

Course objective

The course aims to develop basic skills of students in digital photography to lay a foundation for them as a hobby and/or a profession.

Course outcome:

At the end of the course the students will be able to achieve the following:

CO1: Develop an understanding of the technical aspects and aesthetics of Photography. CO2: Apply the rules of digital photography for creating photographs.

CO3: Develop skills to enhance photographs through post processing. CO4: Create a portfolio of their photographs in selected genre.

Syllabus

Practical 1: **Orientation in digital photography:** Genres, camera handling and settings Practical 2: **Rules of Composition**

Practical 3: **Rules of Composition**: practice sessions

Practical 4: **Understanding Exposure and Art of Pre-Visualization**

Practical 5: **Rules of Composition and Art of Pre-Visualization:** practice sessions Practical 6: **Post Processing Photographs and Portfolio creation**

Practical 7: **Post Processing Photographs:** practice sessions

Practical 8: **Portfolio finalization and presentation in selected genre.**

Reference material

1. Scott Kelby (2020) *The Digital Photography Book: The Step-by-Step Secrets for how to Make Your Photos Look Like the Pros*, Rocky Nook, USA
2. Larry Hall (2014) *Digital Photography Guide: From Beginner to Intermediate: A Compilation of Important Information in Digital Photography*, Speedy Publishing LLC, Newark
3. J Miotke (2010) *Better Photo Basics: The Absolute Beginner's Guide to Taking Photos Like a Pro*, AMPHOTO Books, Crown Publishing Group, USA

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-4	**Introduction to Japanese Language and Culture**	I/II	2	1	50

Course objective

The course aims to develop basic communication skills in Japanese Language and help develop a basic understanding of Japanese culture in cross-cultural communication.

Course outcome

CO1: Gain a brief understanding about Japan as a country and Japanese culture.
CO2: Develop ability to use vocabulary required for basic level communication in Japanese language. CO3: Able to write and read the first script in Japanese language.
CO4: Able to frame simple sentences in Japanese in order to handle everyday conversations CO5: Able to write in basic Japanese about the topics closely related to the learner.

Syllabus

Practical-1: Orientation about Japan, its language, and its culture
Practical-2: Communication Skills 1: Vocabulary for basic Japanese language
Practical -3: Practice sessions
Practical-4: Writing Skills 1: Reading and writing first script in Japanese
Practical-5: Practice sessions
Practical- 6: Communication Skills 2: framing sentences
Practical- 7: Practice sessions
Practical- 8: Writing Skills 2: Write basic Japanese and practice

Recommended reading

1. Marugoto Starter (A1) Rikai - Course Book for Communicative Language Competences, by The Japan Foundation, Goyal Publishers & Distributors Pvt. Ltd (ISBN: 9788183078047)
2. Japanese Kana Script Practice Book – Vol. 1 Hiragana, by Ameya Patki, Daiichi Japanese Language Solutions (ISBN: 9788194562900)

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-5	**Art of Theatre**	I/II	2	1	50

Course objectives:

The course aims to develop in the students, an actor's craft through physical and mental training.

Course Outcomes:

On completion of the course, students will be able to achieve the following:

CO1: Understand and synthesize the working of the prominent genres of theatre across the world. CO2: Apply the skill of voice and speech in theatre and public speaking
CO3: Apply the art of acting and also develop generic skills such as confidence, communication skills, self-responsibility, motivation, commitment, interpersonal skills, problem solving, and self-discipline. CO4: Apply skills acquired related to technical/production aspects of theatre and also develop problem solving and interpersonal skills.

Syllabus:

Syllabus

Practical 1: **Orientation in theatre**
Practical 2: **Voice and Speech training**
Practical 3: **Voice and Speech training**: practice sessions
Practical 4: **Art of acting**
Practical 5: **Art of acting:** practice sessions Practical 6: **Art of script writing**
Practical 7: **Art of script writing:** practice sessions Practical 8: **Final performances**

Reference books:

1. Boleslavsky, R. (2022). *Acting: The First Six Lessons* (1st ed., pp. 1-92). Delhi Open Books.
2. Shakthi, C. (2017). *No Drama Just Theatre* (1st ed., pp. 1-171). Partridge.
3. Bruder, M., Cohn, L. M., Olnek, M., Pollack, N., Previto, R., & Zigler, S. (1986). *A Practical Handbookfor the Actor* (1st ed.). Vinatge Books New York.

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-6	**Introduction to French Language**	I/II	2	1	50

Course objective:

To help build a foundation and interest in French language so that the students can pursue theproficiency levels of the language in higher semesters.

Course outcomes:

On successful completion of the course the students will be able to achieve the following:

CO1. Demonstrate basic knowledge about France, the culture and similarities/differences between India and France

CO2. Learn to use simple language structures in everyday communication.

CO3. Develop ability to write in basic French about themselves and others.

CO4. Develop ability to understand beginner level texts in French

Syllabus

List of Practicals

Practical-1: Orientation about France, the language, and culture

Practical-2: Communication Skills 1: Vocabulary building for everyday conversations

Practical -3: Practice sessions

Practical-4: Reading and writing Skills : Reading and writing simple text in French

Practical-5: Practice sessions

Practical-6: Communication Skills 2: listening comprehension

Practical-7: Practice sessions

Practical-8: Writing Skills: Write basic French and practice

Recommended reading

1. 15-minute French by Caroline Lemoine
2. Cours de Langue et de Civilisation Françaises by G. Mauger Vol. 1.1
3. Cosmopolite I by Natalie Hirschsprung, Tony Tricot

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code	Course Name	Sem.	Hours/week	Credits	**Maximum Marks (Continuous Evaluation)**
HUP0001-7	**Introduction to Spanish Language**	I/II	2	1	50

Course objective:

To help build a foundation and interest in Spanish language so that the students can pursue the proficiency levels of the language in higher semesters.

Course outcomes:

On successful completion of the course the students will be able to achieve the following:

CO1. Demonstrate basic knowledge about Spain, the culture and similarities/differences between India and France

CO2. Learn to use simple language structures in everyday communication. CO3. Develop ability to write in basic Spanish about themselves and others. CO4. Develop ability to read and understand beginner level texts in Spanish

Syllabus

List of Practicals

Practical-1: Orientation about Spain, the language, and culture
Practical-2: Communication Skills 1: Vocabulary building for everyday conversations
Practical -3: Practice sessions
Practical-4: Reading and writing Skills : Reading and writing simple text in Spanish
Practical-5: Practice sessions
Practical-6: Communication Skills 2: listening comprehension
Practical-7: Practice sessions
Practical-8: Writing Skills: Write basic Spanish and practice

Recommended reading

1. 15-Minute Spanish by Ana Bremon
2. Aula Internacional 1 by Jaime Corpas ,Eva Garcia, Agustin Garmendia.
3. Chicos Chicas Libro del Alumno by María Ángeles Palomino

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-8	**Art of Painting**	I/II	2	1	50

Course objective

Painting is fundamentally about learning to see, and to transport that vision onto paper through a variety of mark making techniques. This course aims to develop basic skills of students in painting tolay a foundation for them as a hobby and/or a profession.

Course outcome:

At the end of the course the students will be able to achieve the following:

CO1: Become familiar with the basic methods, techniques & tools of painting.
CO2: Train the eye and hand to develop sense of balance, proportion and rhythm.
CO3: Develop the ability to observe and render simple natural forms.
CO4: Enjoy the challenging and nuanced process of painting.

Syllabus

Practical 1: **Orientation in Painting tools & basics of lines, shapes, light, shadows and textures**
Practical 2: **The art of observation** how to see shapes in drawing Practical 3: **Introduction Water color** how to handle water paints Practical 4: **Introduction to acrylic colors** how to handle acrylic paints

Practical 5: **Explore layering paint and capturing the quality of light with paint.**
Practical 6: **Create landscape painting**
Practical 7: **Create Abstract painting**
Practical 8: **Paint on Canvas** (try to recreate any famous painting)

Reference material

1. Drawing made easy by Navneet Gala; 2015th edition
2. Alla Prima II Everything I Know about Painting--And More by Richard Schmid with Katie Swatland
3. Daily Painting: Paint Small and Often To Become a More Creative, Productive, and Successful Artist by Carol Marine

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-9	**Art of Drawing**	I/II	2	1	50

Course objective

Drawing is fundamentally about learning to see, and to transport that vision onto paper through a variety of mark making techniques. This course aims to develop basic skills of students in drawing to lay a foundation for them as a hobby and/or a profession.

Course outcome:

At the end of the course the students will be able to achieve the following:

CO1: Become familiar with the basic methods, techniques & tools of drawing. CO2: Train the eye and hand to develop sense of balance, proportion and rhythm. CO3: Develop the ability to observe and render simple natural forms.

CO4: Enjoy the challenging and nuanced process of drawing.

Syllabus

Practical 1: **Orientation in Drawing tools & basics of lines, shapes, light, shadows and textures**
Practical 2: **The art of observation** how to see shapes in drawingPractical 3: **One/two-point basic linear perspective**
Practical 4: **Nature drawing and landscapes**
Practical 5: **Gestalt principles of visual composition**
Practical 6: **Figure drawing**: structure and proportions of human body Practical 7: **Gesture drawing:** expression and compositions of human figures Practical 8: **Memory drawing:** an exercise to combine the techniques learnt

Reference material

1. Drawing made easy by Navneet Gala; 2015th edition
2. Perspective Made Easy (Dover Art Instruction) by Ernest R. Norling

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-10	**Nature camp**	II	2	1	50

Course Objective: To create an opportunity for the students to develop affinity with nature and thus subsequently impact their ability to contribute towards sustainability of nature.

Course outcome:

After the completion of the course the students will be able to do the following:

CO1: Develop an affinity with nature by observing and understanding it marvels with guidance from experts

CO2: Develop an understanding of the challenges and solutions associated with nature and its conservation.

Course content

In collaboration with the Forest Department and/or a local NGO working in the field of environment conservation, this course would be conducted in 24 hours. Students will be taken to a tiger reserve in Central Indian region or Forest fringe villages or work with an NGO from Central Indian region working on natural resource management. The camps (for 2 days) will cover any one of the following topics as decided by the course coordinator:

1. Awareness about each element of biodiversity (camps on moths, butterflies, birds, otherwildlife etc)
2. Environment management (water, forest, wildlife) – practices of Forest Department in managing a tiger reserve, and other aspects of water and forest conservation.
3. Sustainable natural resource management - initiatives by rural communities and local NGOs
4. Man-animal conflict and solutions (socio-economic and technical) – role of local communities and Forest Department
5. Traditional practices in environment conservation – role of local communities and local NGOs

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

DEPARTMENT OF PHYSICAL EDUCATION

Syllabus of Semester I UG Engineering Program

COURSE: DISSASTER MANAGEMENT THROUGH ADVENTURE SPORTS

Code: PEP0001-21 **Course Type:** Liberal Arts

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per Week **Total Credits:** 01

Objectives of the Course:

To enable the student:

1. To inculcate rational thinking and scientific temper among the students.
2. To develop critical awareness about the social realities among the students.
3. To build up confidence, courage and character through adventure sports.

Course Outcomes:

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

1. Understand the meaning and importance of Adventure sports.
2. Learn the various types of adventure sports, the equipment and resources required to practice disaster Management activities.
3. Learn the safety measures about different risk and their management.
4. To apply Disaster management theory to institutional & Societal problems andsituations.

Course Content:

1. Basic adventure
2. First AID
3. various types of knots
4. Shelter making
5. Disaster management
6. Team building and goal setting
7. Realization of fear, risk and their roles and analyzing safety Management Plan

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

DEPARTMENT OF PHYSICAL EDUCATION

Syllabus of Semester I UG Engineering Program

COURSE: **SELF-DEFENSE ESSENTIALS AND BASIC KNOWLEDGE OF DEFENSE FORCES**

Course Code: PEP0001-22 **Course Type:** Liberal Arts

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per Week **Total Credits:** 01

Course Outcomes:

On completion of the Course the student will be able to:

- Understand the meaning, need and fitness requirements to implement self-defense
- Learn the basic techniques of selected combative sports.
- Learn to prepare basic Physical Training for Defense forces.
- Implement survival techniques during emergencies.

Course Content:

- General conditioning and self-defense specific conditioning
- Applications of techniques of combative sports for self-defense.
- Self-defense techniques for specific situations: chains natching, knife or stick attack, holding from back or front etc.
- Basic Military Knowledge and exposure making students Confident, bold, disciplined and trains them to join Armed Forces.

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code	CHP0001-31				
Category	Basket of Liberal Learning Course				
Course Title	**Art of Indian traditional cuisine**				
Scheme& Credits	L	T	P	Credits	Semester I/II
	0	0	2	1	

Course outcomes:

At the end of the course the students will be able to achieve the following:

CO1: Understand the factors that affect regional eating habits and the unique ingredients found in variousstates of India

CO2: Get insight to prepare popular dishes from various regions of India. ·

Module 1: Indian Regional foods and snacks - factors effecting eating habits.
Module 2: Indian gravies – ingredients, their importance
Module 3: Indian Sweets - ingredients, their importance
Module 4: Presentation of Indian Meals, Menu Planning, Food Costing
Module 5: Food Preservatives and Safety

List of experiments:

1) Introduction to cookery : does and don'ts
2) Introduction to Indian cuisine, philosophy and classification.
3) Regional influence on Indian Food- factors affecting eating habits
4) Preparation of Garam masala and or Chat masala with ingredients and their importance
5) Preparation of different gravies such as white, yellow or brown gravies with ingredients and theirimportance
6) Preparation of Indian sweets like Besan ke laddu with ingredients and their importance
7) Presentation of meal, Menu planning and Food costing
8) Common chemical food preservatives and their safety standards.

Reference books

[1] Arora, K.,; Theory of cookery; First Edition, Frank Brothers Company (Pub) Pvt. Ltd., 2008 ISBN:9788184095036, 8184095031

[2] Philip, Thangam . E.,; Modern Cookery: Vol. 1; Sixth Edition, Orient BlackSwan., 2008 ISBN:9788125040446, 8125040447ali

[3] Parvinder S;Quantity Food Production Operations and Indian Cuisine (Oxford Higher Education); FirstEdition; Oxford University Press, 2011 ISBN 10: 0198068492 ISBN 13: 9780198068495

[4] Singh, Yogesh; A Culinary Tour of India; First Edition I.K. International Publishing House Pvt. Ltd.
ISBN 978-93-84588-48-9

[5] Singh Shakesh;Simplifying Indian Cuisine;First Edition, Aman Publications, ISBN81-8204-054-X

[6] Dubey Krishna Gopal; The Indian Cuisine;PHI Learning Pvt. Ltd.ISBN978-81 203-4170-8

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code	CHP0001-32				
Category	Basket of Liberal Learning Course				
Course Title	**Introduction to Remedies by Ayurveda**				
Scheme& Credits	L	T	P	Credits	Semester I/II
	0	0	2	1	

Course outcomes:

At the end of the course the students will be able to achieve the following

CO1: Know basic principle of Ayurvedic formulations.

CO2: Different types of Natural Remedies.

CO3: Basic idea about their Characterization

Module 1- Introduction to Ayurveda

Module 2- Different types of Ayurvedic formulations: Churn, Bhasma, Vati, Tailum

Module 3- Introduction to Methods of preparation

Module 4- Characterization, applications

Practicals based on above syllabus

1) Preparations of some medicinal oils like Bramhi tel, Bramhi Awala, Vatnashak Tel, Bhurngraj Tel etc.
2) Preparation of Churn, like Trifala Churn, Hingastak Churn, Trikut Churn etc.
3) Preparation of some Bhasmas and vati

Books

1) Chemistry and Pharmacology of Ayurvedic Medicinal Plants by Mukund Sabnis, Chaukhambha Amarbharati Prakashan.
2) Everyday Ayurveda by Shailesh Rathod
3) A text Book of Rasashastra by Vikas Dhole and Prakash Paranjpe
4) A text Book of Bhaiajya Kalpana Vij¯nana

Syllabus for Semester I, B-Tech (Electronics and Communication Engineering)

Course Code: HUT1004 **Course: Foundational course in Universal Human Value**

L: 1 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits: 1**

Course Objectives

1. To help the student see the need for developing a holistic perspective of life.
2. To sensitize the student about the scope of life – individual, family (inter-personal relationship), society and nature/existence.
3. To strengthen self-reflection.
4. To develop more confidence and commitment to understand, learn and act accordingly.

Course outcomes

On completion of course, students will be able to achieve the following:

CO1: Develop a holistic perspective of life.

CO2: Better understanding of inter-personal relationships and relationship with society and nature.

CO3: An ability to strengthen self-reflection.

Course Content:

Unit 1:- Aspirations and concerns

Need for Value Education: Guidelines and content of value education.

Exploring our aspirations and concerns: Knowing yourself, Basic human aspirations

Need for a holistic perspective, Role of UHV; Self-Management: harmony in human being.

Unit 2:- Health

Harmony of the Self and Body, Mental and physical health; Health for family, friends and society.

Unit 3:- Relationships and Society

Harmony in relationships, Foundational values: Trust, Respect, Reverence for excellence, Gratitude and love; harmony in society; harmony with nature.

Reference Material

The primary resource material for teaching this course consists of

Text book:

R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174- 46781-2

Reference books:

a) B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

b) PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.

c) Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

d) Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA

e) Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.

f) SubhasPalekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) KrishiTantraShodh, Amravati.

g) A Nagraj, 1998, JeevanVidyaekParichay, Divya Path Sansthan, Amarkantak.

h) E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.

i) A.N. Tripathy, 2003, Human Values, New Age International Publishers.

II SEMESTER

SYLLABUS FOR SEMESTER II

B. Tech. (Electronics and Communication Engineering)

Course Code: CHT2002 Course: Chemistry of Functional Materials

L: 2 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 02

Course Outcomes

After the successful completion of the course, students shall be able to

CO1: Investigate the chemical properties of materials for various technological applications.

CO2: Discuss how spectroscopic methods are used for qualitative and quantitative analyses.

CO3: Apply the knowledge of material property and energy to analyze environmental issues.

CO4: Analyze the utilization of sensor technology for environmental issues.

Course Content:

Unit 1: Nano-material (7 Hours)

Nanomaterials: Introduction, Classification and size dependent properties (surface area, Optical and catalytic properties). Synthesis of nano-materials (Solution combustion and Sol-gel methods).

Carbon nanomaterials: Introduction, types, synthesis by modified CVD method, functionalization and applications of CNT and Graphene.

Applications of Nanomaterials

Unit 2: Material Characterization using different Spectroscopic Techniques (7 Hours)

Spectroscopy: Fundamentals of spectroscopy, Interaction of light with matter, Beer's-Lambert's Laws of absorption.

Electronic Spectroscopy: Types of transitions, Chromophores, auxochrome, different type of absorption shifts, Woodward-Fieser Rule.

Nuclear Magnetic Resonance Spectroscopy: Phenomenon of NMR, important aspects of NMR, Prediction of NMR spectrum.

Unit 3: Energy Storage and conversion devices (8 Hours)

Battery: Introduction, types, characteristics, components/materials, working and applications of Lithium-cobalt oxide and metal air batteries.

Super capacitors: Introduction, types (EDLC, pseudo and asymmetric capacitor) with examples and applications.

Energy conversion devices: Introduction, characteristics, materials, working and applications of H2-O2 fuel cells, amorphous Si and quantum dye sensitized solar cells.

Unit4: Sensors and Instrumental method of analysis (7 Hours)

Sensors: Introduction, types of sensors (Piezoelectric and electrochemical), principle, materials used and applications of optoelectronics sensors, piezoelectric sensors, electrochemical sensors and gas sensors.

Instrumental method of analysis: Principle, instrumentation: Colorimetry, potentiometry, conductometry.

Text and Reference Books

1. Energy storage and conversion devices: Supercapacitors, batteries and hydroelectric cells, Anurag Gaur, A. L. Sharma, Anil Arya. 2021, CRC press, 1st edition, ISBN: 978-1-003-14176-1.
2. A. K. Das and M. Das, An introduction to nanomaterials and nanoscience, CBS Publishers and Distributors
3.Smartnanomaterials for sensor application, Li S, Ge Y, Li H, 2012, Bentham Science Publishers, ISBN: 9781608055425.
4. Fundamentals of analytical chemistry: An introduction, Douglas A. Skoogetetal., 2004 Thomson Asia pte Ltd., 8th, ISBN: 978-0-495-55828-6.
5. Chemistry in microelectronics, Yannick Le Tiec, 2013, Wiley Publications, ISBN: 9781848214361.
6. Electronics properties of materials, Rolf E, Hummel, 2012, Springer Publications New York, 4th Edition, ISBN 9781441981639.
7. William Kemp, Organic Spectroscopy, Third Edition, Palgrave Publication, 1991.
8. C. N. Rao,A Muller and A. K. Cheetam, The Chemistry of Nanomaterials: Synthesis, Properties and Applications, Wiley-VCH, 2004

E-books

1. Functional and smart materials, Chander Prakash, Sunpreet Singh, J. Paulo Davim, 2020, CRC Press, ISBN: 978-036-727-510-5.
2. Electrical and electronic devices, circuits and materials: Technological challenges and solutions. Tripathi, S. L., Alvi, P. A., &Subramaniam, U, 2021, John Wiley & Sons, ISBN: 978-0367564261.

Syllabus for Semester II,
B. Tech. (Electronics and Communication Engineering)

Course Code: CHP2002 Course: Chemistry of Functional Materials Lab
L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week Total Credits: 01

Laboratory Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

The students will learn to:

1. Estimate the amount of different elements present in the given samples.
2. Measure molecular /system properties such as surface tension, viscosity of aqueous or other industrially important liquids/mixtures etc.
3. Use of computational tools for analysis of different spectral properties.

List of Experiments for Chemistry Lab

1. Determination of Surface tension of a given liquid / mixture.
2. Determination of Viscosity of a given liquid / mixture.
3. Estimation of Cu and Zn in a brass sample.
4. Potentiometric estimation of iron.
5. Colorimetric estimation of copper.
6. Conductometric estimation
7. Estimation of acid value of oil.
8. Estimation of saponification value of oil.
9. Synthesize a polymer/drug molecule/nano-material.(Demonstration Experiment)
10. Predict and Interpret the NMR spectra (Demonstration Experiment)
11. Spectroscopic/colorimetric determination of wavelength of maximum absorption and determination of unknown concentration by Beers-Lamber Law

Suggested Books/Reference Books

1. Experiments and Calculation in Engineering Chemistry by S. S. Dara, S. Chand Publications.
2. Advanced Practical Physical Chemistry by J. B. Yadav, Krishna's Prakashan Media (P) Limited.
3. Collection of Interesting General Chemistry Experiments, A by A.J.Elias, Universities Press Publications.
4. College Practical Chemistry by V. K. Ahluwalia, S. Dhingra and A. Gulati, Universities Press Publications.
5. Advanced Practical Medicinal Chemistry by Ashutosh Kar, New Age International Publisher.

B. Tech Semester II

(For Electronics & Communication Engineering, Electronics & Computer Science Engineering , Electrical Engineering, Civil Engineering , Mechanical Engineering , Biomedical Engineering)

Course Code: MAT2001 **Course Name: Applied Mathematics II**

L: 2Hrs, T: 1 Hrs, P: 0 Hrs, Per week **Total Credits: 03**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in Calculus and multivariate analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes:

On successful completion of the course, the students will able to:

1. Interpret the solutions of system of linear equations and use the concepts of Eigen values, Eigen vectors to find diagonalization of matrices, reduction of quadratic form to canonical form.
2. Evaluate definite and improper integrals using Beta, Gamma functions. Also trace cartesian curves.
3. Solve multiple integration by change of order, change of variable methods and apply it to find area, volume, mass and center of gravity.
4. Understand geometric meaning of gradient, curl, divergence
5. Perform line, surface and volume integrals of vector-valued functions.
6. Analyze and compare different sets of data and classify the data by means of diagrams and graph.

Course Content:

Module 1: Matrices: (8 hours)

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms, Introduction to n-dimensional space.

Module 2: Integral Calculus: (8hours)

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Tracing of curves (Cartesian form)

Module 3: **Multiple Integrals** (10 hours)
Multiple Integration: Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: area, mass and volume by double integration, Center of mass and Gravity (basic concepts).

Module 4: Vector Calculus (Differentiation)(7hours)
Scalar point function, Vector point function, vector differentiation, gradient, divergence and curl, directional derivatives with their physical interpretations, solenoidal and irrotational motions, Scalarpotential function.

Module 5: Vector Calculus (Integration)(7 hours**)(All Branches except Biomedical Engineering)**
Vector integration: Line integrals, work done, conservative fields, surface integrals and volume integrals, Stoke's theorem, Gauss divergence theorem, Green's theorem and their simple applications.

OR

Module 5: Descriptive Statistics (7- Lectures)(Only for Bio-Medical Engineering)
Types of statistical data: categorical, ranked, discrete, and continuous. Distinction between univariate, bi-variate, and multivariate statistics, Visualization techniques such as joint contingency tables, scatter plots, 2D histograms and line graphs , Measures of central tendency and Dispersion .

Topics for self learning

Rolle's theorem, Mean value theorems, Indeterminate forms, Applications of definite integrals to evaluate perimeter, area, surface areas and volumes of revolutions.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Volume I & II, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).
6. Biomedical Statistics –Shantikumar Yadav, Sompal Singh, Ruchika Gupta
7. Theory and Problems of Probability and Statistics - M.R. Spiegal (McGraw Hill) Schaum Series

Syllabus for Semester II, B.Tech. (Electronics and Communication Engineering)

Course Code: ECT2001 **Course: Network Theory**
L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Objectives

The objective of the course is to make students capable of –

1. Analyzing different electrical networks.
2. Solving electrical circuits using suitable network theorems and methods.
3. Applying suitable transformation techniques to analyze electrical circuits in time and frequency domain.
4. Understanding different parameters of two port networks.

Course Outcomes

At the end of this course students will demonstrate the ability to

1. Understand the fundamentals of nodal and mesh analysis.
2. Analyze the transient and steady state behavior of electrical networks.
3. Apply network theorems to calculate electrical circuit parameters.
4. Estimate the network characteristics from pole-zero locations of network functions.
5. Model two port electrical networks.

Course Content:

Unit I: Node and mesh analysis, matrix approach of networks containing voltage sources, current sources, reactance, Dependent sources, source transformation, duality properties in the electrical networks.

Unit II: Network theorems: Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Compensation theorem, Millman's theorem, as applied to D.C. and AC. Circuits with their applications.

Unit III: Evaluation of initial conditions in RL, RC and RLC networks. Laplace transforms and properties: Partial fraction, inverse Laplace transform, analysis of RC, RL, and RLC networks with and without initial conditions using Laplace Transforms. Steady state response of electrical networks to sinusoidal and non-sinusoidal inputs using Laplace transforms.

Unit IV: Concept of complex frequency, driving points and transfer functions of ladder and non-ladder network structures, Poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations. Behaviors of resonant circuits designed using RLC components.

Unit V: Two port network calculations for impedance, admittance, ABCD and hybrid

parameters. Interconnections of 2-port networks. Introduction to passive low-pass, high-pass, band-pass filters using RLC.

Text Books:

1) Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994.
2) Ravish R. Singh, "Network Analysis & Synthesis" Tata McGraw Hill Education (India) Private Limited (2013).
3) Van, Valkenburg.; " Network analysis" ; Prentice hall of India, 2000.

Reference Books:

1) A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education.

Syllabus for Semester II, B-Tech (Electronics and Communication Engineering)

Course Code: ECT2002 **Course: Electronic Devices**

L: 3 Hrs, T: 0Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Objectives

The objective of the course is to prepare the students:

1. To learn electrical properties, characteristics and behavior of basic solid state devices.
2. To develop applications in circuit design using device models.

Course Outcomes

At the end of this course students will demonstrate the ability to

1. Understand characteristics of electronic devices.
2. Comprehend the fundamentals of MOS technology.
3. Demonstrate the operation of digital circuits using CMOS logic.
4. Select biasing circuits for BJT and FET amplifier.
5. Analyze electronic circuits.

Course Content:

Unit I

BJT biasing:AC/DC load line concept, Operating Point Analysis, need of biasing, biasing techniques, bias stabilization, compensation techniques, Application of BJT as Amplifier.

Unit II

Low frequency analysis of an amplifier: Determination of h-parameters from I-V characteristics, Analysis of amplifier at low frequency to estimate voltage gain, current gain, input resistance, output resistance etc.

Unit III

Field effect Transistor: JFET classification, construction, principle of operation, I-V characteristics, FET amplifier configuration, Biasing techniques, Applications of FET.

Unit IV

Introduction to MOS and CMOS Technology: - Classification of ICs, MOS transistor, MOSFETI-Vcharacteristics, Body Effect, Applications of MOSFET, Implementation of Boolean Expressions using CMOS.

Unit V

Power Electronics Devices: Characteristics and working principle of Power devices such as SCR, UJT, TRIAC, DIAC, IGBT and PUT.

Text Books:

1. Integrated Electronics: Jacob Millman , Christos Halkias, Chetan Parikh, Second Edition,TMH.
2. An Introduction to semiconductor Devices: Donald Nemen, Tata-McGraw Hill
3. CMOS VLSI Design – A Circuits and Systems Perspective: Neil Weste and David Harris, Addison-Wesley, 4th Edition, Pearson.
4. Power Electronics: M. D. Singh and K. B. Khanchandani, Second Edition, TMH.

Reference Books:

1. Electronic devices and Circuit Theory: R. Boylestad, 9th edition, Pearson Education
2. Electronic Devices and Circuits: David A. Bell, 4th Edition, PHI.
3. Electronic Circuits – Analysis and Design: Donald Nemen, Tata-McGraw Hill
4. Power electronics: P. S. Bimbhra, Fifth edition,khanna Publication.
5. Basic VLSI Design: Douglas Pucknell and Kamran Eshraghian, Third Edition, PHI
6. **S**olid State Electronic Devices: Ben G Streetman, Sanjay Kumar Banerjee, Sixth Edition, PHI.

Syllabus for Semester II, B-Tech (Electronics and Communication Engineering)

Course Code: ECP2002 **Course: Electronic Devices Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course Objectives

The objective of the course is to prepare the students:
To verify the characteristics of different electronic devices and verify it using EDA tools.

Course outcomes

At the end of this course students will demonstrate the ability to

1. Plot V-I characteristics of electronic components and analyze performance parameters.
2. Study biasing techniques and examine effect of temperature on the performance of an amplifier
3. Investigate Characteristics of power electronic devices.
4. Verify Boolean logic of CMOS gates.
5. Use EDA tool for analysis of electronic circuits

Experiments based on:

- Characteristics of transistors
- Biasing of BJT
- Characteristics of Power Devices
- Circuit Simulations using EDA tool
- Implementation of Boolean Expression using CMOS

Syllabus for Semester II, B-Tech (Electronics and Communication Engineering)

Course Code: ECT2003 **Course: Object Oriented Programming**
L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Objectives

1. To make students understand Fundamental features of an object oriented language Java: it's object classes and interfaces, exceptions and libraries of object collections
2. Introduce students with fundamental concepts like exception handling, generics, multithreading and streams.

Course Outcomes

On successful completion of the course, students will be able to demonstrate

1. Understand the principles of object-oriented programming; create classes, instantiate objects and invoke methods.
2. Apply the concepts of generics and implement collection classes and develop reusable programs using the concepts of OOP.
3. Apply the concepts of Multithreading and Exception handling to develop efficient and error free Codes for solving classic synchronization problems.
4. Create design Pattern in Software design process.

Course Content:

UNIT I: Features of Object Oriented Programming languages, Abstraction, Encapsulation, Inheritance, polymorphism and late binding, Concept of a class, Access control of members of a class, instantiating a class, constructor and method overloading and overriding.

UNIT II: Concept of inheritance, methods of derivation, use of super keyword and final keyword in inheritance, run time polymorphism, abstract classes and methods, Interface, implementation of interface, creating packages, importing packages, static and non-static members, Lambda Expressions Introduction, Block, Passing Lambda expression as Argument.

UNIT III: Exceptions, types of exception, use of try catch block, handling multiple exceptions, using finally, throw and throws clause, user defined exceptions, file handling in Java, Serialization, Generics, generic class with two type parameter, bounded generics. Collection classes: Arraylist, Linked List, Hashset, Treeset.

UNIT IV: Multithreading: Java Thread models, creating thread using runnable interface and extending Thread, thread priorities, Thread Synchronization, Inter Thread communications.

UNIT V: Introduction to Design Patterns, Need of Design Pattern, Classification of Design Patterns, and Role of Design Pattern in Software design, Creational Patterns, Structural Design Patterns and Behavioral Patterns.

Text Books:

1. Herbert Schildt; JAVA, the Complete Reference; Ninth Edition, TataMcGraw- Hill Publishing Company Limited.
2. Design Patterns by Erich Gamma, Pearson Education.

Reference Books:

1. Cay S. Horstmann and Gary Cornell; Core JAVA Volume-II Advanced Features; Eighth Edition; Prentice Hall, Sun Microsystems Press2008.
2. Herbert Schildt and Dale Skrien; Java Fundamentals A Comprehensive Introduction; Tata McGraw HillEducationPrivateLtd2013.

Syllabus for Semester II, B-Tech (Electronics and Communication Engineering)

Course Code: ECP2003 **Course: Object Oriented Programming Lab.**

L: 0 Hrs, T: 0 Hr, P: 2 HrPer Week **Total Credits: 1**

Course Objectives

1. To develop ability of students to implement basic concepts and techniques of object oriented programming paradigm like encapsulation, inheritance, polymorphism, exception handling.
2. Develop solution to problems using collection classes, generics, streams, multithreading.

Course Outcomes

On completion of the course the student will be able to

1. Design solution to problems using concepts of object oriented programming like classes, objects, inheritance with proper exception handling.
2. Use collection classes, generic classes to design programs and perform database connectivity.
3. Implement programs based on streams and multithreading.

Experiments based on

- Data types, variable, operators, arrays and control structures
- Class, methods and objects
- Exception Handling
- Multithreading
- I/O operations
- Applet structure and event handling

Syllabus for Semester II, B. Tech. Electronics and Communication Engineering

Course Code: ECP2004 **Course: Computer Workshop-1 Lab**

L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits: 1**

Course Objective

The objective of this course is to familiarize the students with Computer components, its functioning and configuration with peripherals hardware and develop the skill towards troubleshooting.

Course Outcomes

After successful completion of this course, the student will be able to,

1. Understand components functioning of a computer and procedure to assemble-disassemble it.
2. Install operating system and configure the computer as per the external devices.
3. Install necessary tools and packages to use them maintaining cyber hygiene.
4. Troubleshoot the fault in hardware and software and suggest the preventive measures.
5. Demonstrate an application on computer.

Course Content:

Unit-1: Computer Hardware

Identification of hardware components of computer, configuration of each peripheral, disassemble and assemble the PC back to working condition, installation of operating system like Linux or Windows on the personal computer, Hardware troubleshooting and Software troubleshooting.

Unit-2: Internet & World Wide Web

Local Area Network configuration and TCP/IP setting to access the Internet, Web Browsers, plugins, proxy settings. Using search engines, installation of antivirus and block active x downloads to avoid viruses and/or worms. Basics of HTML.

Laboratory Exercise:

1. Personal Computer (PC) identification of components, functionality, its assembly - disassembly and configuration.
2. Installation of Operating system and configuring it for dual boot.
3. Hardware troubleshooting of peripherals and devices like printer, scanner, mouse, keyboard, monitor and other devices.
4. Software installation and troubleshooting of licensed and open source softwares and packages like Matlab, Orcad, Simulink, Multisim, Python, Scilab, etc.
5. Local Area Network(LAN) configuration and TCP/IP setting using user interface and Command Line Interface (CLI) like ping, if config, ipneigh, nslookup, etc.
6. Antivirus setup and configuration for online protection, scheduled scan, definition updates, etc.

7. Web Browser configuration and customization for search engine, addons and plugins, proxy settings.
8. Example of HTML web page including text fields (plain and urls), images, animation, etc.

Text Books:

1. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
2. Comdex Information Technology course tool kit by Vikas Gupta, WILEY Dreamtech

Syllabus for Semester II, B. Tech. (Electronics and Communication Engineering)

Course Code: HUT2001 **Course: Foundational Literature of Indian Civilization**

L: 2 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 02**

Course outcome

At the end of the course the students will be able to achieve the following:

CO1: Understand the Indian knowledge system and its scientific approach

CO2: Get introduced to the Vedic corpus and recognize the multi-faceted nature of the knowledge contained in the Vedic corpus

CO3: Understand the salient features of the philosophical systems of the Vedic and non-Vedic schools

CO4: Develop a basic understanding of the ancient wisdom recorded in various Indian literary work

Course Content:

Unit 1: Overview of Indian Knowledge System: Importance of ancient knowledge, defining IKS, IKS classification framework, Historicity of IKS, Some unique aspects of IKS.

Unit 2: The Vedic corpus: Introduction of Vedas, four Vedas, divisions of four Vedas, six Vedangas, Distinct features of Vedic life.

Unit 3: Indian Philosophical systems: Development and unique features, Vedic schools of philosophy, Samkhya and Yoga School of philosophy, Nayay and Vaisesika school of philosophy, Purva-mimamsa and Vedanta schools of Philosophy, Non-vedic philosophies: Jainism, Buddhism, and other approaches

Unit 4: Indian wisdom through ages: Panchtantras, Purans: contents and issues of interests, Itihasa: uniqueness of the two epics (Ramayan and Mahabharata), Key issues and messages from Ramayana, Mahabharata – a source of worldly wisdom; Indian ancient Sanskrit literature: Kalidas, Vishakadutta, Bhavbhuti, Shudraka*

*any one text as decided by the course teacher

Reference material

1. B. Mahadevan, Vinayak Rajat Bhar, Nagendra Pavana R. N., "Introduction to Indian Knowledge System: Concepts and Applications" PHI, 2022

2. S.C. Chatterjee and D.M. Datta, An introduction to Indian Philosophy, University of Calcutta, 1984

Syllabus for Semester II, B. Tech. (Electronics and Communication Engineering)
Course Code: PET2001/PEP2001 Course: Sports-Yoga-Recreation
L: 1 Hrs, T: 0 Hr, P: 2 Hrs. Per week Total Credits: 02

Aim of the Course

The course aims at creating awareness about the fundamentals of Physical Education, Sports, Yoga, Recreation and its effectiveness to promote Health and wellness through Healthy Lifestyle.

Course Objective

1. To impart the students with basic concepts of Sports, Yoga and Recreational activities for health and wellness.
2. To familiarize the students with health-related Exercise and evaluate their Health-related Fitness.
3. To make Overall growth & development with team spirit, social values and leadership qualities among students through various sports, games and Yogic activities.
4. To create Environment for better interaction and recreation among students as neutralizer for stress through various minor and recreational games.

Course Outcomes

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

1. Understand fundamental skills, basic principle and practices of sports and Yoga.
2. Practically learn the principles of implementing general and specific conditioning of physical exercises and yoga.
3. Develop Health-related fitness and Body-mind co-ordination through various fitness activities, sports, recreational games and yoga.
4. Practice healthy & active living with reducing Sedentary Life style.

Course Content

Unit 1: - Theory: Introduction

• Meaning, Definition and Importance of Health & Wellness
• Dimensions of Health and Wellness
• Factors influencing Health and Wellness
• Physical Fitness, Nutrition, Habits, Age, Gender, Lifestyle, Body Types
• Health & Wellness through Physical Activities, Sports, Games, Yoga and

Recreation activities
• Causes of Stress & Stress relief through Exercise and Yoga
• Safety in Sports

Unit 2: - Practical- Exercises for Health and Wellness

• Warm-Up and Cool Down - General & Specific Exercises

• Physical Fitness Activities
• Stretching Exercises
• General & Specific Exercises for Strength, Speed, Agility, Flexibility, coordinative abilities
• Cardiovascular Exercises
• Assessment of BMI
• Relaxation techniques
• Physical Efficiency Tests

Unit 3: - Yoga
• ShukshmaVyayam
• Suryanamaskar
• Basic Set of Yogasanas – Sitting, standing, supine and prone position
• Basic Set of Pranayama & Meditation

References:
1. Russell, R.P. (1994). Health and Fitness Through Physical Education. USA: Human Kinetics.
2. Uppal, A.K. (1992). Physical Fitness. New Delhi: Friends Publication.
3. AAPHERD "Health related Physical Fitness Test Manual."1980 Published by Association drive Reston Virginia
4. Kumar, Ajith. (1984) Yoga Pravesha. Bengaluru: RashtrothannaPrakashana.
5. Dr. Devinder K. Kansal, A Textbook of Test Evaluation, Accreditation, Measurements and Standards (TEAMS 'Science)

III SEMESTER

Syllabus for Semester III, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT3001 **Course: Electronic Circuits**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to:

1. Understand the concept of feedback amplifiers.
2. Comprehend Transistorized Multi vibrators and wave shaping circuits.
3. Analyze frequency response of multistage amplifiers.
4. Estimate the performance parameters of Power amplifiers.
5. Design voltage regulators.

Unit I:
Power amplifiers: Class A, B, AB, C amplifiers, Operation and Analysis, Merits and Demerits, Push-pull amplifier configurations.

Unit II:
Multistage Amplifiers: Calculation of Gain, Methods of Coupling – RC Coupling, Transformer Coupling, Direct Coupling, Techniques of improving input impedance – Darlington transistors and Bootstrapping, Frequency response of RC Coupled transistor amplifier.

Unit III:
Feedback amplifiers: Feedback Topologies, effect of feedback on bandwidth, gain, stability,Transistorized Oscillators: Barkhausen Criterion, RC Phase Shift Oscillator, Wein Bridge Oscillator, LC Oscillator, Crystal oscillator, frequency stability analysis.

Unit IV:
Transistorized Multivibrators and Waveshaping Circuits: - Astable, Monostable and BistableMultivibrators, clipper and Clamper Circuits.

Unit V:
Regulated Power Supply: - Design of Transistor shunt regulator, emitter follower type voltage regulator, series voltage regulator with Darlington pair. Design factors to consider – output peak to peak ripple, over voltage and over load protection.

Text Books:

1. Integrated Electronics: *Millman, Halkias,Parikh TMH, 2nd Edition*
2. Microelectronic Circuits: *Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, Oxford University Press*

Reference Books:

1. Electronic Devices and Circuit Theory: *R. Boylestad, Pearson Education, 9th Edition*
2. Foundation of Electronics Circuits and Devices: *Meade, Thompson, 4th Edition*
3. Electronic Devices and Circuits: *David A. Bell, PHI. 4th Edition*
4. Pulse and Digital Waveshaping Circuits: *Millman and Taub, TMH*
5. Microelectronics Circuit Analysis and Design: *Donald Nemen, Tata-McGraw Hill*
6. Electronic Devices and Circuits: *Salivahanan, 2nd Edition, Tata McGraw Hill.*

Syllabus for Semester III, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP3001 **Course: Electronic Circuits Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes

At the end of this course students will demonstrate the ability to:

1. Select the feedback topologies for amplifier configuration.
2. Analyze electronic circuits using simulation software.
3. Determine the frequency response of multistage amplifier.
4. Design waveshaping circuits.
5. Design Voltage Regulators.

Experiments based on following topics:

- Circuit simulation
- Series Voltage Regulator
- Single Stage and Two stage RC coupled amplifier using BJT
- Oscillator
- Feedback Amplifier
- Multivibrators, Clippers and Clampers

Syllabus for Semester III, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT3002 **Course: Analog Circuits Design**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to:

1. Understand the concepts of OP-AMP and its performance parameters.
2. Understand linear and non linear applications of OP-AMP.
3. Apply feedback topologies in OPAMP based Circuits.
4. Analyze op-amp application circuits.
5. Design active filters & Timer IC 555 based circuits.

Unit I:

Differential amplifier, DC and AC analysis, Biasing configurations of Differential amplifier, Constant current Bias circuits, Level shifting techniques, cascaded differential amplifier stages, Characteristics of an operational amplifiers, Open loop and closed loop Op-amp Configuration, Op-amp Parameters & their analysis.

Unit II:

Simple Op-amp Circuits: inverting, non-inverting amplifiers, summers, integrators and differentiators, log, antilog circuits, Differential amplifier configurations, instrumentation amplifiers, Current to voltage and voltage to current converter

Unit III:

Precision rectifiers, sinusoidal oscillators:RC phase shift, Wein bridge, Quadrature oscillator, with frequency and amplitude stabilization, elementary idea of active filter, First /second order Low pass and High pass Butterworth filters, Band pass and Band reject filters.

Unit IV:

Op-amp's non-Linear application: Clipper, clamper, comparator, zero crossing detector , Schmitt trigger circuits, Triangular wave generator, Monostable, Astablemultivibrator circuits using op-amps, sample and hold circuits, D/A converter: Binary weighted resistor type and R-2R ladder, A/D converter: The parallel comparator (Flash) type, Successive approximation converter.

Unit V:

Integrated Circuits: Timer IC LM-555, Internal block schematic, astable, monostable configurations and its application, PLL IC 565: Operating principle lock range and capture range, PLL application: frequency multiplier and FSK demodulator, Integrated Circuit Voltage Regulators.

Text Books:

1. Linear Integrated Circuits: D. *Roy Choudhary, Shail Jain, New Age International*.
2. Operational Amplifiers Design & Applications: *Tobey Graeme, Huelsman, McGraw hill*
3. OP-AMPS and Linear Integrated Circuits: *RamakantGaikwad, PHI*

Reference Books:

1. Design with Operational Amplifiers and Analog Integrated Circuits: *Sergio Franco, TMH, 3rd Edition*
2. Operational Amplifiers: *G. B. Clayton, International Edition*
3. Operational Amplifiers and Linear Integrated Circuits: *Coughlin Driscoll, PHI, 4th Edition.*
4. Analog Filter Design: *M. E. Van Valkenburg ,PHI*.
5. Op-Amps and linear ICs*: Fiore J. M, Thomson Delmar learning.*

Syllabus for Semester III, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP3002 **Course: Analog Circuits Design Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes

At the end of this course students will demonstrate the ability to:

1. Analyze analog circuits using simulation software.
2. Perform mathematical operations using OPAMP.
3. Implement Linear and nonlinear applicationsof OPAMP.
4. Estimate parameters affecting the performance of the amplifier.
5. Design Multivibrators using IC 555.

Experiments based on following topics:

- Circuit simulation.
- Linear Applications of OPAMP
- Non Linear Applications of OPAMP
- IC – 555
- Voltage Regulators using IC723

Syllabus for Semester III, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT3003 Course: Digital System Design with HDL

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 03

Course outcomes

At the end of this course students will demonstrate the ability to:

1. Understand fundamentals of Hardware Description Language.
2. Realize Boolean expressions of digital logic circuits.
3. Design digital circuits using Finite State Machines.
4. Design combinational and sequential circuits using Hardware Description Language.
5. Design digital functions using Programmable Logic Devices and FPGAs.

Unit I –

Introduction to Logic Gates and implementation in Combinational and Sequential Logic Design, Introduction to Verilog, Fundamentals of Verilog including language basics and relation to circuit implementation, Concept of SOP,POS and Karnaugh maps.

Unit II –

Modules and Ports in Verilog, modeling techniques in Verilog, Task and Functions, Synthesis and Simulation, Timing and delays, Verilog constructs and codes for combinational and sequential circuits.

Unit III –

Combinational Circuits (using Verilog): Comparators, Multiplexers and De-multiplexer, Encoder, Decoder, Halfand Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU.

Unit IV –

Sequential Circuits (using Verilog): Latches/buffers and Flip-Flops as memory storage elements, Counters, Shift registers and its variants, Memory and its internal organization, FSM design.

Unit V -

Concepts and Generic architecture of PAL, PLA, PLD and FPGA's, Synthesis and Implementation of Boolean functions using programmable logic devices.

TextBooks:

1. R.P.Jain,"ModerndigitalElectronics",TataMcGrawHill,4thedition,2009.
2. Stephen Brown and ZvonkoVranesic, "FundamentalsofDigital Logic with Verilog Design" TataMcGrawHill, 3rd ed, 2009.

ReferenceBooks:

1. Douglas Perry, “VHDL”, Tata McGraw Hill, 4thedition, 2002
2. W.H. Gothmann, “Digital Electronics- An introduction to theory and practice” , PHI, 2nd edition ,2006
3. M. Morris Mano and Michael Ciletti,“Digital Design: With an Introduction to Verilog HDL”, 5e, 2011
4. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 1989
5. Samir Palnitkar“Verilog HDL-A guide to Digital Design and Synthesis”SunSoft Press 1996
6. Charles Roth, “Digital System Design using VHDL” , Tata McGraw Hill 2nd edition
   2012

Syllabus for Semester III, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP3003 **Course: Digital System Design with HDL Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes

At the end of this course students will demonstrate the ability to:

1. Examine functionality of digital integrated circuits.
2. Apply simulation tools to test the functionality of logical circuits.
3. Write and debug Hardware Description Language programs.
4. Perform simulation & synthesis of combinational and sequential circuits using Verilog.
5. Implementdigital circuits on FPGA.

Experiments based on following topics:

1. Combinational and sequential circuits.
2. Different techniques of modeling.
3. Verilog statements and test benches.
4. Design of arithmetic blocks in Verilog and implement the same.

Syllabus for Semester III, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT3004 **Course: Signals and Systems**

L: 2 Hrs, T: 1 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes-

At the end of this course students will demonstrate the ability to:

1. Understand the classification of signals & systems.
2. Characterize the LTI system in terms of impulse response.
3. Analyze continuous time systems using Laplace Transform
4. Analyze discrete time systems using Z-Transform
5. Investigate stability of the system.

Unit I

Signals and systems as seen in everyday life, in various branches of engineering and science, Types of Signals, Types of Systems, System properties: linearity –additivity and homogeneity, Time-invariance, causality, stability, Operations on Signals – Time Shifting, Time Scaling and Time Inversion, Elementary Signals.

Unit II

Linear Time – Invariant (LTI) systems, Representation of discrete time signals using shifted and weighted impulses, impulse response analysis – The Convolution, input- output behavior with aperiodic & periodic convergent inputs, Characterization of causality and stability of linear time-invariant systems based on impulse response analysis.

Unit III

Analysis of Continuous Time Systems: Laplace domain analysis, region of convergence, poles and zeros of system, Properties of Laplace Transform, Properties of Region of Convergence, Inverse Laplace Transform, Transfer Function, Impulse and Step Response, Stability and Causality of the Continuous Time LTI system based on region of convergence in S-plane.

Unit IV

Analysis of Discrete Time Systems: z-domain analysis, The z-Transform for discrete time signals and systems, region of convergence, Properties of z-transform, Properties of Region of Convergence, Inverse z-transform, Transfer Function, Impulse and Step Response, Stability and Causality of the Discrete Time LTI systems based on region of convergence in z-plane.

Unit V

Representation of Continuous Time systems using Differential Equations, solution to Linear constant coefficient differential equations using Laplace Transform, Representation of Discrete Time systems using Difference Equations**,** solution to Linear constant coefficient Difference equations using z-transform.

Text Books:.

1) V**.** Krishnaveni, A. Rajeswari, “Signals and Systems”, Wiley India Pvt. Ltd., New Delhi, 2013.
2) B. P. Lathi, “Linear Systems and Signals”, OXFORD University Press.
3) Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
4) A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983**.**

Reference Books:

1) M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
2) J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
3) M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB",TMH, 2003.
4) J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
5) Ashok Ambardar,"Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.
6) R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
7) Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.

Syllabus for Semester III, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT2980 – 1 Course: Electronic Sensors for Industrial applications (Open Elective – 1)

L: 2 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 02

Course outcomes-

At the end of this course students will demonstrate the ability to:

1. Understand Errors in instrumentation systems.
2. Learn Classification of Transducers based on their functionality.
3. Explore different types of sensors
4. Comprehend Smart Sensor architecture.
5. Select the suitable sensors and transducers for desired application.

Unit I

General Configuration and Functional Description of measuring instruments: Block schematic of general instrumentation system (Analog and Digital), Static and Dynamic Characteristics of Instrumentation system, errors in instrumentation system, Standards and calibration, Active and Passive Transducers and their classification.

Unit II

Motion Transducers: Resistive strain gauge, LVDT, Capacitive transducers, Piezo-electric transducers, vibrometers and accelerometers.

Temperature Transducers: Thermistor, RTD, Thermocouple and their characteristics.

Piezoelectric Transducers: Piezoelectric phenomenon, Piezoelectric materials, Force, Strain, Torque, Pressure and Acceleration transducers.

Unit III

MagnetostrictiveTransducers: Magnetostriction phenomenon, Force, Torsion transducers, Hall Effect Transducers.

Electromechanical Transducers: Tachometers, Variable reluctance, Electrodynamic pressure, Electromagnetic flow meters.

Unit IV

Photoelectric Transducers and Sensors: Photoelectric phenomenon, Photoconductive, Photovoltaic, Photoemmisive.

Sensors: Proximity Devices, Bio-Sensors, Smart-Sensors, Piezo-electric Sensors.

Text Books:.

1. Transducers and Instrumentation: *Murty D.V. PHI, 10th print 2003*
2. Mechanical and Industrial Measurements: *Jain R.K., Khanna Publ. 10th Edition-4th reprint 2000*
3. Electrical and Electronic Measurements and Instrumentation: *Sawhney A. K., DhanpatRai and Sons.*

Reference Books:

1. Sensors and Transducers: *Patranabis D., PHI, 2nd edition*
2. Instrumentation Devices and Systems:*Rangan C. S., Sharma G. R., Mani V. S. V., Tata McGraw Hill Publication Limited.*
3. Instrumentation Measurement and Analysis:*Nakra B. C., Chaudhary K. K., Tata McGraw Hill Publication Limited.*

Syllabus for Semester III, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT2980 – 2 Course: Fundamentals of Computer Networking
(Open Elective – 1)

L: 2 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 02

Course outcomes-

At the end of this course students will demonstrate the ability to:

1. Understand computer networking and reference models.
2. Comprehend the protocols implemented at various layers of reference model.
3. Identify components of computer networks, switching, addressing and routing techniques.
4. Analyze error control techniques.
5. Examine security in computer networks

Unit I

Introduction to computer networks and the Internet, Network types: LAN, MAN, WAN, Reference models- OSI and TCP/IP.

Unit II

Hubs, Switches, Bridges, Routers, Transmission media, Switching, Error detection and control, IPv4 addressing, Routing protocols

Unit III

World Wide Web (WWW), Hyper Text Transfer Protocol (HTTP), File Transfer (FTP), Domain Name System (DNS), Electronic Mail (E-mail),

Unit IV

Security: Cryptography, Digital Signature

Text Books:

1) 1. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4 th Edition

2) 2. J.F. Kurose and K. W. Ross, “ Computer Networking – A top down approach featuring the Internet”, Pearson Education, 5th Edition

Reference Books:

1) 1. Andrew Tanenbaum, “Computer networks”, Prentice Hall 2. William Stallings, “Data and computer communications” , Prentice Hall

2) 2. T. Viswanathan, “Telecommunication Switching System and Networks”, Prentice Hall

Syllabus for Semester III, B. Tech. (Electronics and Communication Engineering)

Course Code: MAT3004 Course: Applied Mathematics – III

L: 2 Hrs, T: 1 Hr, P: 0 Hrs. Per week Total Credits: 03

Course outcomes-

At the end of this course students will demonstrate the ability to:

1. Understand the concept of Laplace Transform along with its properties and apply Laplace Transform to solve ordinary and partial differential equations.
2. Apply Z-transform to solve difference equation, and understand the fundamental concepts of discrete-time signals and systems.
3. Find the Fourier transform of algebraic and trigonometric function along with the analysis of these transferred functions.
4. Understand the theory of analytic function, complex integration, including line integrals, contour integration, and the Cauchy Integral Theorem.
5. Solve various types of linear and nonlinear partial differential equations, including the wave equation, transmission line equations.

Course Pre-requisite: Basic knowledge of differential equations and calculus.

Unit I

Laplace transforms and its existence, properties of Laplace transform, inverse Laplace transform and application of Laplace Transform to solve differential equations.

Unit II

Definition and properties of Z- Transform,inverse of $Z-$ transform, region of convergence, and relation with Laplace transform, application of Z-transform to solve difference equations.

Unit III

Fourier Transform – Fourier Integral Theorem, Fourier Sine and Cosine Integrals, Fourier transform and its properties,Finite Fourier Sine and Cosine Transforms.

Unit IV

Lagrange's partial differential equation of first order, Homogeneous PDE of nth order with constant coefficient, method of separation of variables, Applications of partial differential equations to solve the problems of transmission line.

Unit V

Function of complex variables, Differentiation of function of complex variables, Cauchy-Riemann equations, analytic functions, harmonic functions, findingharmonicconjugate,Cauchy Integral formula (without proof), Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof).

Text Books:

1) B. S. Grewal, Higher Engineering Mathematics, Khanna publishers 43rd edition (2015).

2) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

1) N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

2) J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

Syllabus for Semester III, B. Tech. (Electronics and Communication Engineering)

Course Code: CHT3001 **Course: Environmental Science**

L: 2 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 02**

Course outcomes-

At the end of this course students will demonstrate the ability to:

1. Develop an understanding of pollution and its types.
2. Learn about different kinds of sources of pollution.
3. Explain sustainable development, its goals, targets, challenges and global strategies for sustainable development
4. Understand different methods of assessing environmental quality and associated risks.

Unit 1: Environmental Pollution I

Air pollution: Sources of air pollution; Primary and secondary pollutants; carbonmonoxide, lead, nitrogen oxides, ground-level ozone, particulate matter and sulphurdioxide; Other important air pollutants. Indoor air pollution; Adverse health impactsof air pollutants; National Ambient Air QualityWater pollution: Sources of water pollution; marine pollution and groundwaterpollution; Water quality parameters and standards; adverse health impacts of waterpollution on human and aquatic life, treatment scheme for waste water from different industry.

Unit 2: Environmental Pollution II

Soil pollution and solid waste: Soil pollutants, hazardous wastes and their sources;Impact on human health.Introduction, types of e-wastes, environmental impact, e-waste recycling, e-wastemanagementrules.Noise pollution: Definition of noise; Unit of measurement of noise pollution; Sourcesof noise pollution; Noise standards; adverse impacts of noise on human health, recentadvances in noise pollution control and benefits.Thermal and Radioactive pollution: Sources and impact on human health andecosystems.

Unit 3: Environmental Sustainability

Introduction to sustainable development: Sustainable Development Goals (SDGs)-targets and indicators, challenges and strategies for SDGsGreen Technology: goals and significance, sustainabilityGreen chemistry, challenges to green technology, advantage and disadvantages ofgreen processes, Eco mark certification- its importance and implementation

Unit 4: Environmental laws and regulation

Introduction to environmental laws and regulation: Constitutional provisions- Article48A, Article 51A (g) and other derived environmental rights; Introduction toenvironmental legislations on the forest, wildlife and pollution control.Environmental management system: ISO 14001Environmental audit and impact assessment; Environmental risk assessment Pollutioncontrol and management.

Reference Books:

1. Ahluwalia, V. K. (2015). Environmental Pollution, and Health. The Energy and Resources Institute (TERI).
2. B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut
3. P AarneVesilind, J. Jeffrey Peirce and Ruth F. Weiner, EnvironmentalPollution and Control, Butterworth-Heinemann
4. P.T. Anastas& J.C. Warner, Green Chemistry: Theory & practice, Oxford University Press.
5. Environmental Pollution and its control Techniques by Dr. S.S. Dara.

IV SEMESTER

Syllabus for Semester IV, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT4001 **Course: Electromagnetic Fields**

L: 2 Hrs, T: 1 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to:

1. Understand static electric and magnetic fields, their behavior in different media, associated laws, boundary conditions and electromagnetic potentials
2. Visualize different coordinate systems to understand the spatial variations of the physical quantities dealt in electromagnetic field theory.
3. Apply the principles of electromagnetic statics to the solutions of problems relating to electromagnetic field, potential, and work.
4. Apply Maxwell‘s equations for solutions of problems pertaining to uniform plane wave propagation
5. Analyze propagation of Electromagnetic Waves

Unit – I

Vector Algebra & Co-ordinate Geometry: Cartesian, Cylindrical and Spherical co-ordinate systems, differential lengths, differential surfaces, differential volumes, Gradient, divergence & curl of a vector & their physical interpretation.

Unit – II

Time Invariant Electric Fields, Energy and Potentials: Coulomb's law, Electric Field Intensity, Electric Flux Density, Gauss law, Applications of Gauss’s law, Divergence Theorem, Work Done, Potential Difference, Potential Gradient, Poisson’s & Laplace equations.

Unit – III

Time Invariant Magnetic Fields: Biot-Savart’s law, Ampere’s circuital law and applications, Magnetic field due to current carrying conductor of infinite length, Magnetic flux and Flux density, Gauss law**,** Lenz’s law, Stokes’ Theorem.

Unit – IV

Time-Varying Fields and Maxwell's Equations: Displacement current and Displacement current Density, The equation of Continuity for Time varying Fields, Faraday's law, Maxwell's equations for steady fields, Maxwell's equations for time varying fields, Transformation of time varying quantity into phasor and vice versa, Maxwell's equations in phasor form.

Unit – V

Uniform Plane Waves: Electromagnetic wave equation, Propagation constant, attenuation constant, phase constant, Poynting vectors theorem, Solution of wave equation in free space, conducting and dielectric media, Skin effect, Depth of Penetration.

Text Books:

1. "Engineering Electromagnetics": *William Hyat, John Buck ; Tata McGraw Hill.*
2. Electromagnetic Waves & Radiating Systems: *Advard C. Jordan, Keith G. Balman, Second Edition, Prentice-Hall of India Pvt. Ltd.*

Reference Books:

1. Problems and Solutions in Electromagnetics: *W. H. Hyat, J. A. Buck, Tata McGraw Hill Education Private Limited, New Delhi.*
2. Theory and Problems of Electromagnetics: *Joseph A. Edminister, Schaum's outline series in Engineering, McGraw Hill Book Company.*
3. Electromagnetic Fields: *K. B. MadhuSahu, 2nd Edition, Scitech Publications Pvt ltd.*

Syllabus for Semester IV, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT4002 Course: Analog and Digital Communication

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 03

Course outcomes :

At the end of this course students will demonstrate the ability to

1. Understand fundamentals of analog and digital communication system
2. Analyze the performance of the receiver under optimum conditions.
3. Analyze the effect of noise on analog communication systems.
4. Estimate parameters of digital communication systems.
5. Detect output signals of digital modulation techniques.

Unit I:

Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems – DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

Unit II

Sources of Noise, Classification of Noise, Effect of Noise in amplitude modulation systems, Pre-emphasis and De- emphasis,

Unit III

Pulse modulation, Sampling process, Pulse Amplitude and Pulse code modulation (PCM),Noise considerations in PCM, Differential pulse code modulation, Delta modulation, Adaptive delta modulation

Unit IV

Digital Modulation schemes- BinaryAmplitude Shift Keying, Binary Frequency Shift Keying, M-ary Frequency Shift Keying, Minimum Shift Keying, Binary Phase Shift Keying, Differential Phase Shift Keying, Quadrature Phase Shift Keying, Quadrature Amplitude Modulation.

Unit V

Convolution Coding, Maximum likelihood sequence detection (Viterbi Detection), Sequential detection, Recent trends in modern communication systems

Text Books:

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. B. P. Lathi, “Modern Digital and Analog Communication Systems”, Third Edition, Oxford University press.

Reference books:

1. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
2. Taub H. and Schilling D.L., "Principles of Communication Systems”, Tata McGraw Hill, 2001.
3. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering", John Wiley, 1965.
4. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
5. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.
6. George Kenndey, 4th Edition , “ Electronics Communication systems ”

Syllabus for Semester IV, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP4002 Course: Analog and Digital Communication Lab

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week Total Credits: 01

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand functional blocks of transmitter and receiver in communication systems.
2. Estimate functioning of analog and digital communication system using simulation platforms
3. Determine desired parameters of analog and digital modulation techniques experimentally.
4. Analyze performance of analog and digital modulation scheme
5. Evaluate the performance of analog and digital communication techniques

Experiments based on the following topics

- Amplitude Modulation
- Frequency Modulation
- SNR calculation
- Pulse Code Modulation
- Delta Modualtion
- Adaptipe Delta Modualation
- TDM
- Communication Receiver
- Communication Software Study
- Digital Modulation Scheme

Syllabus for Semester IV, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT4003 Course: Microcontrollers and Peripherals

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 03

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand Architecture, functional diagram of microcontrollers compared to microprocessor
2. Infer the programming needs of microcontrollers in terms of assembly language and embedded C.
3. Apply the knowledge of architecture and programming to interface various peripherals with microcontrollers
4. Analyze and simulate algorithms of microcontrollers in regards to the circuit requirement.
5. Design solution for the complex systems using microcontroller.

Unit I

Introduction to microcontroller Intel 8051 architecture, functional pin diagram and its description, Organization of internal RAM, ROM and register banks, organization SFR and flags, Ports functionality.

Unit II

Addressing modes, Instruction set of 8051, Organization of hardware interrupt structure, Vector interrupt table, External memory interfacing, and basic assembly/Embedded C language programming concepts with examples for various software routines.

Unit III

Counters and timers, serial data communication, input/output devices interfacing and application development with microcontroller using keyboards, LEDs, LCD displays, pulse measurements, D/A and A/D conversions, stepper motor.

Unit IV

ARM Processor architecture: Register Set, Modes of operation and overview of Instructions and software routine development, Interrupts and Device Drivers: Exceptions and Interrupt handling Schemes –Context & Periods for Context Switching, Deadline & interrupt latency.

Unit V

Basic Concepts of RTOS, Hard and Soft Real Time Systems, Tasks –periodic and aperiodic tasks, Timing parameters –release time, execution time, deadline, period, Basic real time Task Scheduling Algorithms, Resource Contention, Deadlocks, Priority Inversion, Basics of Re-entrancy and Thread Safety in Embedded Software Development.

Text Books:

1. Muhammad Ali Mazidi& Janice GilliMazidi, R. D. Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.
2. Embedded Microcomputer Systems, Real Time Interfacing –Jonathan W. Valvano –Brookes / Cole, 1999, Thomas Learning.
3. ARM System Developer's Guide Designing and Optimizing System Software - Andrew N. Sloss, Dominic Symes, Chris Wright, Morgan Kaufmann Publishers.

Reference Books:

1. Real Time Systems – Design for distributed Embedded Applications: HermaK.Kluwer Academic.
2. Operating Systems – A Design Oriented approach: Charles Crowley, McGraw Hill.
3. The 8051 Microcontroller – Architecture, Programming and Applications – Kenneth J. Ayala, West Publishing Company.
4. ARM Architecture Reference Manual, David Seal, Adison Wesley Publication.

Syllabus for Semester IV, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP4003 Course: Microcontrollers and Peripherals Lab

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week Total Credits: 01

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand programming for microcontrollers 8051 and ARM7TDMI LPD2148
2. Demonstrate hardware interfacing with microcontroller and its programming requirements.
3. Formulate algorithms of microcontroller in regards to the circuit requirement.
4. Simulate and analyze the developed algorithm on a simulator
5. Design solution for the complex systems using microcontroller.

Experiments based on following topics:

- Programs based on timers
- programs based on serial communication
- programs based on memory accessing
- Programs based on interrupts.
- Programs based on interfacing of peripheral devices like ADC, DAC, LCD, Keyboard, LEDs, Stepper motor.

Syllabus for Semester IV, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT4004 Course: Data Structures and Algorithms

L: 2 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 02

Course outcomes-

At the end of this course students will demonstrate the ability to:

1. Understand the concepts of arrays and their operations to design applications.
2. Understand the concepts of queues and its types to solve the real world problems.
3. Understand tree data structure to formulate the problem, devise an algorithm and transform into code.
4. Solve real world problems using various linked list algorithms and techniques.
5. Apply stacks mechanism and algorithms to design various applications.

Unit I

Introduction to Data Structures: Definition, Arraysimplementation in memory, Types of arrays. Applications of Arrays: Polynomial Representation Using Arrays, Addition and multiplication of Two Polynomial.
Sorting & Searching: General Background, Different Sorting & Searching Techniques and their complexities.

Unit II

Linked List: Concept of Linked Lists, Types, Operations on Linked lists, concept of Doubly Linked List, HeaderLinked List. Other Operation & Applications: Reversing a Linked List, Concatenation of Two Lists.

Unit III

Stacks: Definition and example, primitive operations on Stacks, Arithmetic expressions (Infix, Postfix andPrefix), Evaluating postfix expression, converting an expression from infix to postfix. Applications of stacks: Tower of Hanoi Problem, Recursion.

Unit IV

Queues: Definition and examples of queues, primitive operations, Types of Queues.

Trees: Definition and Basic Terminology of trees, Binary Tree, Binary Search Tree, Tree Traversal.

Text Books:

1) Data Structures and Program Design: Robert Kruse, PHI.
2) Classical Data Structure: Samanta, PHI.
3) Fundamentals of Data Structures: Elis Horowitz, SartajSahani, Galgotia Publications.
4) Data Structures And Algorithms: Alfred V.Aho , John E.Hopcroftand Jeffrey D Ullman, Pearson.

Reference Books:

1) Schaum's Outlines Data structure: Seymour Lipschutz, Tata McGraw Hill 2nd Edition.
2) Data Structures and Algorithms, G A V Pai, Tata McGraw Hill.

Syllabus for Semester IV, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP4004 **Course: Data Structures and Algorithms Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes-

At the end of this course students will demonstrate the ability to:

1. Implement various data structures and operations on them.
2. Implement various mathematical expression evaluation and memory & CPU management using stacks and queues.
3. Implement different types of trees and different algorithms.

Following practicals can be executed/ implemented using C or Java language:

1. Study and implementation of one dimensional array and their operations.
i) Traversing ii) Insertion iii) Deletion
2. Study and implementation of two dimensional array and their operations.
i) Traversing ii) Multiplication iii) Transpose
3. Study and implementation of various Searching techniques using arrays:
i) Linear Search Method ii) Binary Search method
4. Study and implementation of various Sorting techniques using arrays:
i) Bubble Sort ii) Selection Sort iii) Insertion Sort iv) Merge Sort
v) Quick Sort
5. Study and implementation of polynomials and their operations.
i) Addition ii) Multiplication
6. Study and implementation of various operations on Single Link List:
i) Add a node at the front ii) Insert a node at a given position
iii) Add a node at the end iv) Delete a front Node v) Delete a node from given position
7. Applications of single linked list:
i) Reversing a linked list ii) Concatenation of two lists
8. Study and implementation of PUSH and POP operations on Stack using array.
9. Study and implementation of Circular Queue using array:
i) Insert an elements in queue ii) Delete an element from queue
10. Study and implementation of Binary tree traversals: INORDER, PREORDER and POSTORDER.

Syllabus for Semester IV, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT2990 – 1 **Course: Electronics in Agriculture**
(Open Elective – 2)

L: 2 Hrs, T: 1 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand the importance of electrical energy for the benefits of agricultural development.
2. Identify the role and responsibility of an engineer in the agricultural sector.
3. Understand the diversity of precision farming.
4. Infer the modern remote sensing technology for agricultural development.
5. Differentiate advanced agricultural technologies for Indian agronomy.

Unit I:

Role of engineering in agricultural sector, Professional responsibilities and professional ethics, engineering divisions in agricultural sector, Environmental issues, various government policies for research and development under agricultural engineering for productivity enhancement.

Unit II:

Use of electrical energy in agriculture, electromechanical energy conversion, Electrical motors, Selection of motors for different farming applications, renewable energy sources, Instrument for measurement: pH, Electrical conductivity, gas analysis, humidity, leaf area, chlorophyll content and soil moisture & temperature.

Unit III:

Remote Sensing and Application**:** data acquisitionsystems, Test sites, Common measurements, Geologic investigations, Agriculture and Forestry investigations, Atmospheric investigation, visual image interpretation, digital image processing, Earth resource satellite .

Unit IV:

Precision Farming:An introduction to precision farming. GIS/GPS positioning system for precision farming, Yield monitoring and mapping, soil sampling and analysis, Computers and Geographic information systems, Precision farming-Issues and conditions, Role of electronics in farm machinery for precision farming.

Unit V:

Advanced Agricultural Technologies:Difference between traditional and modern agricultural practices; Internet of Things (IoT), Online Marketing of agrobased products, Information and Communication Technology (ICT), Mobile Technology, Agricultural Drones & Robotics, Artificial Intelligence (AI) based farming.

Text Books and Reference Books:

1. Bhatia, S.L. "Handbook of Electrical Engineering". Khanna Publications.
2. Bsown, R.H., "Farm Electrification". McGraw Hills, 1956.
3. ConsidineT..M. "Process/Industrial Instruments and Controls· Handbook", McGraw Hill 1993.
4. Kuhar, John. E. 1977. The precision farming guide for agriculturalist. Lori J. Dhabalt, USA
5. Barret, E.C. and Curits, L.F. "Introduction to Environmental Remote Sensing". John Wiley and Sons Inc. New York, 1976.
6. Megh R. Goyal, “Emerging Technologies in Agricultural Engineering” Apple Academic Press.

Syllabus for Semester IV, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT2990 – 2 **Course: Evolution in Communication Technologies (Open Elective – 2)**

L: 2 Hrs, T: 1 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Recall the need and aspects of Telecommunication Engineering in modern world.
2. Understand use of different modulation techniques used in Analog and Digital Communication.
3. Acquire basic knowledge of advanced Telecommunication systems and their applications.
4. Compare and contrast advantages and limitations of various Telecommunication systems.
5. Explore the applications of Mobile Communication.

Unit I

Basics of Telecommunication Engineering:

Definition of Telecommunication, Examples of telecommunications and evolution, various types of telecommunication systems such as telephone network, Radio broadcasting system, Computer networks, Internet etc., General Block schematic of communication system, Communication channels, Analog versus digital communication systems, Need of modulation, Types of analog modulation such as AM and FM, Types of digital modulation such as Pulse code modulation, delta modulation, Continuous wave modulation such as ASK, FSK, PSK.

Unit II

Introduction to Optical Fiber Communication

Use of optical fiber in communication, Principle and working of OFC system, Block diagram, Types of optical fibers, various elements required in designing OFC system, Applications such as long distance transmission links, Computer communication networks etc.

Unit III

Introduction to Satellite Communication

Use of satellite in telecommunications, Launching of Satellite from earth station, Types of satellite orbits, Classification of satellite according to applications, Satellite communication link block diagram.

Unit IV

Concepts in Wireless communications

Wireless Standards: Overview of 2G and 3G, 4G cellular standards, Multiple access schemes-FDMA, TDMA, CDMA and OFDM, Modulation schemes – BPSK, QPSK.
GSM, Wi-Fi & Wi-Max, Bluetooth,

Unit V

Basics of Mobile Communication

Cellular concepts- Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Signal propagation-Propagation mechanism-reflection, refraction, diffraction and scattering, large scale signal propagation, Antennas for mobile terminal- monopole antennas, base station antennas and arrays.

Text Books:

1) Communication Electronics: *Simon Haykin, 4th Edition, John Wiley Publication.*
2) George Kenndey*, 4th Edition , " Electronics Communication systems "*
3) *Digital Communication: John G. Proakis, Tata McGraw Hill*
4) *Satellite Communication : T . Prat, C.W. Bostian, Wielly Publication*

Reference Books:

1) Wireless communication – Principles and Practice: *Theodore S. Rappaport, Pearson Education.*
2) Optical Fiber Communication – Principles and Practice: *John M. Senior, Pearson Education.*

Syllabus for Semester IV, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP4005 **Course: Electronic Measurement Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand the fundamentals of electronic measurements.
2. Perform resistance measurement using DC Bridges.
3. Perform capacitance and inductance measurement using AC Bridges.
4. Validate the characteristics of transducers.
5. Use simulation platforms for parameter measurement of electronic circuits

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Experiments based on:

- DC bridge for Resistance Measurement
- AC bridge Circuit for capacitance measurement
- AC bridge Circuit for Inductance measurement
- Signal Conditioning circuit for Temperature Measurement
- Error compensation study using Numerical analysis using MATLAB (regression)
- LABVIEW/ Virtual Lab

Syllabus for Semester IV, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP4006 Course: Co curricula Activities/ Community/Field Project

L: 0 Hrs, T: 0 Hr, P: 4 Hrs. Per week Total Credits: 02

Students will be evaluated on the basis of their participation in voluntary services, performance in games and sports, performance in literary activities, performance in cultural activities and their participation at Regional/State/National and International level in technical and co-curricular events.

Desirable: Development of Technical/ Community/ Field Project pertaining to the domain of Electronics and Communication Engineering.

Syllabus for Semester IV, B. Tech. (Electronics and Communication Engineering)

Course Code: HUT4001 Course: Business Communication

L: 2 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 02

Course Objective

The course aims to develop the skills of students to proficiently craft compelling business documents and employ strategic verbal communication techniques. By honing these skills, students will gain the ability to convey ideas persuasively and interact confidently in diverse business contexts.

Course Outcomes

On successful completion of the course the students will be able to achieve the following:

1. Understand the fundamentals of business communication.
2. Apply tools and techniques to create effective workplace correspondence.
3. Analyse and apply visual design principles to create business documents.
4. Understand and evaluate information to draft reports.
5. Apply and evaluate strategies for effective communication for employment.

UNIT 1: Fundamentals of Business Communication

Definition of communication, Emergence of communication as a key concept in the Corporate and Global world, Types- Internet, Blogs, E-mails, social media, Channels- Formal and Informal: Vertical, Horizontal, Diagonal, Grapevine, Persuasive Communication-Negotiation Skills, PAC concept

UNIT 2: Business Correspondence

Planning, Writing, and Completing Business Messages

Personnel Correspondence: Job Application Letter, Letter of Acceptance of Job Offer, Letter of Resignation, Letter of Appointment, Promotion and Termination, Letter of Recommendation

Trade Correspondence: Inquiry, Order, Credit and Status Enquiry, Complaints, Claims, Adjustments, Consumer Grievance Letters

UNIT 3: Visual and Content Creation

Visual design principles, Ethics of visual communication, selecting visuals for presenting data, Content Creation: Website, Help file, User Guides, Promotional leaflets and fliers

UNIT 4: Reports

Basic formats and types of reports - Feasibility, Progress, Project, Case Study Evaluation, Agenda, Notices, Minutes of Meeting, Organizational announcements, Statement of Purpose

UNIT 5: Communication for Employment

Pre-interview technique- NOISE Analysis, Job Description and Resume, Creating LinkedIn Profile, Effective use of job portals, Business etiquette.

Text Books

1. Sharon Gerson, Steven Gerson, "Technical Communication: Process and Product", 2018, Pearson
2. Courtland L Bovee, John V Thill and RoshanLal Raina "Business Communication Today", 14th edition Pearson
3. P.D. Chaturvedi and MukeshChaturvedi, Fundamentals of Business Communication, Pearson Publications, 2012.

Reference Books

1. Shalini Verma, Business Communication, Vikas Publishing House Pvt. Ltd., 2015.
2. Sanjay Kumar, PushpaLata, Communication Skills, 2nd Edition, Oxford Publication, 2018
3. William Strunk Jr. and E.B. White, The Elements of Style, Allyn & Bacon, A Pearson Education Company, 2000

SEMESTER – V

Syllabus for Semester V, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT5001 Course: Probability Theory and Stochastic Processes

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 03

Course outcomes

At the end of this course students will demonstrate the ability to

1. Define and Interpret probability density and distribution by modeling sample spaces.
2. Illustrate the characteristics of random processes as applied to communication and signal processing
3. Apply the theorems related to random signals for analysis of datasets
4. Evaluate response of linear systems to random processes.
5. Construct the probability distribution of random variables, based on real-world situations and use it to compute statistical parameters

Unit I

Review ofSet theory, Random experiments and probabilities, Independent and Mutually exclusive events, Axiomatic definition of probability, Joint, Conditional and Total Probabilities, Law of addition and multiplication of probabilities, Bayes theorem and applications.

Unit II

Continuous & Discrete Random Variables, Probability / Cumulative Distribution Function, Probability Density Functions, Probability Mass Functions, Conditional and joint distributions and densities, Expectation, Conditional Expectations, Variance, Standard Deviations and Moments of random variable.

Unit III

Standard Discrete Distributions - Bernaulli's, Binomial, Poisson and Geometric. Standard Continuous Distributions - Uniform, Normal (Gaussian), Exponential. Interval Estimation, Markov and Chebyshev Inequalities.

Unit IV

Independent and identically distributed (iid) random variables, Strong and weak laws of large numbers, Central limit theorem. Random sequences, Modes of convergence, almost sure convergence, convergence in Mean Square, convergence in Probability, convergence in Distribution.

Unit V

Basic Definitions and Important Random Processes, Useful classifications of Random Processes. WSS Random Processes, Ergodic Random Processes, Mean, Autocorrelation Function and covariance functions, Power spectral density, Introduction to LTI systems, Transmission of random processes through LTI systems.

Text Books:

1) A.Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill
2) H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education
3) S. Palaniammal, “Probability And Random Processes” PHI publication.

Reference Books:

1) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
2) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
3) S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.
4) S. P. Eugene Xavier, “Probability Theory and Random Processes”, S. Chand & Company
5) Dr. Remadevi S., Bindu Krishnan, “Probability Distributions, Random Processes and Numerical Methods”, Wiley India Pvt. Ltd.

Syllabus for Semester V, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT5002 **Course: Digital Signal Processing**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand DFT and FFT algorithms, filter design techniques, multirate systems and digital signal processors.
2. Apply DFT and IDFT to signals and systems.
3. Design of digital filters for given specifications.
4. Design of multirate systems for given specifications.
5. Optimize and realize complex structures of discrete systems using digital signal processors.

Unit I

Discrete Fourier Transform (DFT), Properties of DFT, Inverse Discrete Fourier Transform (IDFT), Circular Convolution using DFT/IDFT, Use of DFT in linear filtering. Fast Fourier Transform (FFT) Algorithms.

Unit II

Structures for realization of LTI discrete-time systems in z domain: IIR systems: Direct Form-I, Direct Form-II, Cascade form and parallel form. FIR systems: Direct form, cascade form and linear phase realization.

Unit III

Design of discrete time IIR filters from continuous time filters, IIR filter design by the Bilinear Transformation, Butterworth filters, Chebyshev filters.

Design of FIR filters by windowing method – Bartlet, Blackman, Hanning, Hamming and Kaiser.

Unit IV

Multirate signal processing, Sampling Rate Conversion, Decimation, Interpolation, Multistage Decimators and Interpolators design, Applications of multirate signal processing such as subband coding, digital filter banks, QMF filter banks.

Unit V

DSP processor memory Architecture, Some examples of DSP Processors, Overview of TMS320 Family DSP processors.

Text Books:

1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
2. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
3. Salivahanan, Digital Signal Processing, Tata McGraw Hill.

Reference Books:

1. S. K. Mitra, Digital Signal Processing: A computer based approach.TMH
2. Jonathan Stein, Digital Signal Processing, Wiley India Ltd.

Syllabus for Semester V, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP5002 **Course: Digital Signal Processing Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand the basics of software tool used for digital signal processing.
2. Analyze discrete signals in time and frequency domain.
3. Design digital filters along with its realization (Structures).
4. Design multirate signal processing systems such as decimators, Interpolators.
5. Implement DSP applications on DSP (processor) starter kit.

Experiments based on following topics:

- DFT, IDFT of discrete signals.
- Circular convolution by DFT-IDFT method.
- FFT of discrete signals.
- Design of Structures for realization of LTI discrete-time systems in z domain.
- Design of IIR filters.
- Design of FIR filters.
- Design of decimators.
- Design of Interpolators.
- Study and experimentation with DSP processor kit.

Syllabus for Semester V, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT5003 **Course: VLSI Design**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand VLSI Design Flow.
2. Use design rules for circuit layout.
3. Interpret CMOS inverter characteristics.
4. Estimate Circuit Characterization and performance.
5. Design combinational and sequential circuits using CMOS logic.

Unit I

VLSI Design Flow, Introduction to MOS Transistors, Non Ideal I-V Behavior, DC Transfer Characteristics, MOS Transistor as a switch, Inverter characteristics, Integrated Circuit Layout: Design Rules, Parasitics. Delay: RC Delay model, linear delay model, logical path efforts.

Unit II

Circuit Characterization and Performance Estimation: Introduction, Resistance Estimation Capacitance Estimation, CMOS gate transistor sizing, Driving Large capacitive loads, Scaling of MOS transistors.

Unit III

Layout Design Rules, CMOS process Enhancement: Interconnect, power, CAD and Manufacturing Issues: DRC, Circuit Extraction and Robustness.

Unit IV

Designing combinational logic gates in CMOS: Static Design Models, Ratioed Logic, Pass-Transistor Logic, Dynamic CMOS Design, Issues in Dynamic Design, Domino Logic, dual rail logic.

Unit V

Sequential MOS Logic Circuits: Introduction, Behavior of Bistable Elements, The SR Latch Circuit, Clocked Latch & Flip-Flop Circuit, CMOS D-Latch & Edge-Triggered Flip-Flop.

Text Books:

1. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and SystemsPerspective,4th Edition,Pearson EducationIndia,2011.
2. J.Rabaey,DigitalIntegratedCircuits:ADesignPerspective,PrenticeHallIndia,1997.

Reference Books:

1. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979
2. P.Douglas,VHDL:programming by example, McGrawHill, 2013.
3. L. Glaserand D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985.
4. N.H.E. Weste and Kamran Eshraghian, Principles of CMOS VLSI Design: A System Perspective.

Syllabus for Semester V, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP5003 **Course: VLSI Design Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Use VLSI Design methodologies & CAD tools.
2. Analyze the design trade off in various partitioning, placement and floorplanning in VLSI Design Automation.
3. Simulate moderately sized CMOS circuits that realize specified digital functions.
4. Design CMOS circuit layout.
5. Design combinational and sequential circuits using CAD tools.

Lab practice based on:

1. Introduction to MOSFETs

2. CMOS inverter – Static Characteristics

3. CMOS inverter – Dynamic Characteristics

4. Load inverters – Ratioed Logic (Resistive Load, Pseudo NMOS)

5. Layout Design

6. Implementation with Static CMOS Style

7. Implementation with Dynamic CMOS Style

8. Sequential Circuits

Syllabus for Semester V, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT5004 Course: Computer Architecture and Organization

L: 2 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 02

Course outcomes

At the end of this course students will demonstrate the ability to

1. Study the block diagram and architecture of computer systems.
2. Emulate multiplication and division algorithms.
3. Analyze the performance of computational algorithms.
4. Implement combinational and sequential logic using Programmable Logic Devices.
5. Design control unit for execution of functional blocks.

Unit I

Basic Structure of Computers, Functional units, software performance issues, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Queues, Subroutines. Register level design- general characteristics, Register level combinational and sequential components, design methods. Processor level design- components, design techniques

Unit II

Processor organization, Information representation, number formats. Multiplication & division algorithms, Multiplier & divider design, ALU design, Floating Point arithmetic, IEEE 754 floating point formats

Unit III

Control Design, Instruction sequencing, Interpretation, Hardwired control-Design methods, and CPU control unit. Micro programmed Control- Basic concepts, minimizing microinstruction size, multiplier control unit. Micro programmed computers- CPU control unit.

Unit IV

Memory organizations, device characteristics, RAM, ROM, Memory management, Concept of Cache & associative memories, Virtual memory.

Unit V

System organization, Input-Output systems, Interrupt, DMA, Standard I/O interfaces, Concept of parallel processing, Pipelining, Forms of parallel processing,RISC & CISC architecture, Recent Trends/Developments.

Text Books:

1. "Computer Architecture and Organization", Hayes J. P, PHI, Second edition / Third edition
2. "Computer Organisation", V. Carl Hammacher, Fifth Edition

Reference Books:

1. "Computer System Architecture", M. M. Mano, Edition
2. "Structured Computer Organisation", A. S. Tanenbum, PHI, Third edition
3. "Computer Organization and Microprogramming", Y. Chu, II, Englewood Chiffs, N. J.,
   Prentice Hall Edition
4. "Computer Organization and Programming", C.W.Gear, McGraw Hill, N. V. Edition

Syllabus for Semester V, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP5004 Course: Computer Architecture and Organization Lab

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week Total Credits: 01

Course outcomes

At the end of this course students will demonstrate the ability to

1. Describe the functional behavior of processor components such as ALU, register file, control unit, and memory blocks used in instruction execution
2. Implement individual processor components using Verilog HDL and simulate their functionality with basic instruction test cases.
3. Integrate datapath components to simulate instruction execution and analyze signal-level interactions between modules.
4. Verify the correctness of arithmetic and logical operations by interpreting simulation results and debugging HDL test benches.
5. Design and simulate a simplified processor datapath that performs instruction fetch, decode, and execution for given test programs.

Experiments based on:

- Integration of ALU and ALU control unit of MIPS processor together and test it using a test bench. Encode the instructions to be executed by ALU and generate these encoded test vectors to control the ALU operations.
- Integration of register Files, ALU control etc. Write a top module to connect these modules using wires in Verilog HDL.
- Write a top module to connect the instruction memory, data memory, register files, ALU and ALU control together.
- Encode one logical and one arithmetic instruction in the instruction memory.
- Initialize the data memory fields with the data. Verify the ability to fetch instructions from instruction memory. Write a Verilog test bench with arithmetic and logical instruction cases for testing these components.

Syllabus for Semester V, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP5005 Course: Electronic Design Workshop

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week Total Credits: 01

Course outcomes

At the end of the course the students will be able to:

1. Understand the functioning of required project components.
2. Simulate and optimize the circuit using Simulation Software.
3. Develop programs using Integrated Development Environment.
4. Design PCB using CAD tools and fabricate.
5. Assemble, test and validate the solution for real life problems.

Exploration of the following topics (but not limited to):

1. Identification of Electronic Components and Testing.
2. Datasheet interpretation.
3. Fabrication and testing of small electronics circuits.
4. PCB Design and its testing.
5. Study of Indian standards in the electronic industry.
6. Manufacturing practices in the electronicindustry.
7. Microcontroller based mini project.
8. Technical Report writing and demonstrating /presentation of mini projects.

Reference Books/website:

1. Electronic Component and Materials: *Dr. Madhuri Joshi*
2. Printed Circuit Boards – Design and Technology: *Walter Bosshart, McGraw Hill Education.*
3. Integrated circuit Fabrication Technology: *David J. Elliott, Tata McGraw Hill.*
4. www.electronicstds.gov.in
5. www.deity.gov.in (Department of Electronics and Information Technology, Ministry of Communication and IT, Government of India)

Syllabus for Semester V, B. Tech. (Electronics and Communication Engineering)
Course Code: ECT5006 – 1 Course: Information Theory and Coding
(Program Elective – 1)

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 03

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand the concept of information theory and channel capacity
2. Apply source coding techniques to improve transmission efficiency
3. Construct the encoder and decoder of the linear block codes to improve the reliability of the system
4. Analyze encoding and decoding of the cyclic codes to improve the reliability of the System
5. Analyze encoding and decoding of the convolution and turbo codes to improve system reliability

Unit I

Information Theory: Amount of information, Entropy, Joint entropy, Conditional entropy, Relative entropy, Mutual information, Relationship between entropy and mutual information,capacity of a noiseless binary channel, binary symmetric channel, Gaussian channel, Bandwidth-SNR trade-off.

Unit II

Source Coding: Classification of codes, Kraft inequality, Coding efficiency, Shannon-Fano coding, Huffman coding, The Lempel-Ziv coding, Run-length encoding, The JPEG Standard for Lossy Compression.

Unit III

Linear Block Codes: Introduction to error control codes, error detection and correction, automatic repeat request, forward error correction codes: systematic linear block codes encoding, syndrome decoding, hamming code, construction of low-density parity check codes, tanner graph, decoding of LDPC codes.

Unit IV

Cyclic Codes: Introduction, cyclic codes generation, Matrix Description of cyclic codes, Burst error correction, Golay codes, CRC codes, Circuit implementation of cyclic codes. BCH and RS Codes , BCH codes, Decoding of BCH codes, R S codes, Implementation of RS encoders and decoders

Unit V

Convolutional and Turbo Codes: Convolutional codes – Encoding and State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes,Viterbi algorithm, Sequential decoding ,Stack algorithm. Interleaving techniques – Block and convolutional interleaving, ARQ, Types of ARQ, Performance of ARQ, Probability of error and throughput,Iterative design of Turbo codes, Decoding of Turbo codes: Iterative map method, The BCJR algorithm.

Text Books:

1.Ranjan Bose, Information Theory, Coding and Cryptography, Publication,2005.

2.Cover, Thomas, and Joy Thomas. Elements of Information Theory. 2nd ed. New York, NY:

3.N. Abramson, Information and Coding, McGraw Hill, 1963.

4.M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.

Reference Books:

1.R.B. Ash, Information Theory, Prentice Hall, 1970.
2.Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.
3.SimonHaykin, *Communication Systems* , 4 th edition, Wiley Publications, 2001.

Syllabus for Semester V, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT5006 – 2 **Course: Smart Sensors**

(Program Elective – 1)

L: 3 Hrs, T: 0Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Study fundamentals of sensors and transducers.
2. Understand sensor materials and its characteristics for an application.
3. Comprehend the essentials of Smart Sensors.
4. Examine Sensor fabrication techniques and identify specific process details.
5. Case studies of Smart sensor applications and systems.

Unit-I

Sensor Characteristics: Transfer function, accuracy, calibration, hysteresis, nonlinearity, saturation, repeatability, dead band, resolution, output impedance, excitation, dynamic characteristics, environmental factors, reliability and application characteristics.

Unit-II

Review of transducers for various parameters like temperature, pressure, flow, level, humidity, acceleration, vibration etc.

Sensors fabrication: Design considerations and selection criterion as per standards, Sensor fabrication techniques, process details, and latest trends in sensor fabrication.

Unit-III

Smart sensors:Fundamentals, IEEE 1451 standard for smart sensors,Sensor Signals and Systems, Sensor specifications, Sensor Characteristics, Physical principles of sensing,

Unit-IV

Sensor Materials and overview of sensor technologies: Silicon as Sensing Material, Plastics, Metals, Ceramics, Glasses, Optical Glasses, Nanomaterials. Overview of Surface Processing technologies.

Unit- V

Applications ofSmart Sensors, Fiber optic sensors (Optical sensor), Accelerometer, Chemical sensors, biosensors, gas sensors, Industrial Applicationof Smart Sensors:Overview of automated consumer products: Smart Cars, Smart Homes, Smart Domestic Appliances, Smart Toys etc.

TEXT BOOKS:

1. D.V.S.Murty, "Transducers and Instrumentation", Second edition, PHIpublication, Secondedition, 2010.
2. Randy Frank, "Understanding Smart Sensors", Artech House Inc., 2nd Edition.
3. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs, and Applications", Springer; 4th editon.

REFERENCE BOOKS:

1. Gerard Meijer, "Smart sensor systems", Wiley, 2008
2. W Gopel, J. Hesse, J. N. Zemel, "Sensors A Comprehensive Survey" Vol. 9, Wiley-VCH, 1995
3. S. M. Sze, "Semiconductor Sensors", Wiley-Interscience,1994

Syllabus for Semester V, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT5006 – 3 **Course: MEMS and NEMS (Program Elective – 2)**

L: 3Hrs, T: 0Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of the course the students will be able to:

1. Understand the evolution and classification of MEMS and NEMS.
2. Understand the working principle of micro/nano sensors and actuators.
3. Elaborate the fabrication process modules.
4. Explore the RF MEMS devices for applications in communication systems.
5. Apply the mechanics associated with device modeling.

Unit I

Introduction to Micro Electromechanical Systems (MEMS): Historical background, Micro and Nano scale systems introduction to design,Scaling effects, Benefits of Miniaturization, Devices andstructures definitions. Materials used in M/NEM Systems

Unit II

Types of MEMS: Optical MEMS, Bio- MEMS, RF- MEMS (Capacitor, Inductor, Resonator), Micro fluidics

Unit III

Fabrication modules: Oxidation, Deposition, Lithography, Etching. Micromachining, Wafer Bonding, Packaging

Unit IV

Micro/Nano Sensors and Actuators overview: Pressure sensor, capacitive accelerometer, Chemical sensor, Gas sensor and Biosensor. Electrostatic Comb drive, Magnetic microrelay.

Unit V

Mechanics of solids: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods, Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems, modeling based on case study of a device.

Text Books:

1. G. K. Ananthasuresh, K. J.Vinoy, S .Gopalkrishnan K. N. Bhat,V.K.Aatre, Microand

   Smart Systems,Wiley India,2012.

2. S.E.Lyshevski, Nano-andMicro-Electromechanical systems: Fundamentals of Nano-andMicro engineering (Vol.8) .CRC press, (2005).
3. S.D.Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M.Madou, Fundamentals of Microfabrication, CRCPress,1997.

Reference Book:

1. G.Kovacs, Micro machined Transducers Source book, McGraw-Hill, Boston,1998.
2. M.H.Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, NewYork,2000.

SEMESTER – VI

Syllabus for Semester VI, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT6001 **Course: Embedded Systems**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand the evolution, exposure and tool chain utilized for ARM microcontrollers
2. Identify the programming needs of ARM cortex microcontroller in terms of architecture and programmers model
3. Apply the knowledge of architecture and develop the embedded C based programming skills required for microcontroller
4. Deploy and configure Embedded environment to demonstrate interfacing of peripherals.
5. Design and emulate the analyzed algorithms using the emulator.

Unit –I: Introduction to Embedded System

Design Considerations for Embedded Systems, Evolution of ARM Microcontrollers in Embedded systems. Embedded System Development Process - Tool Chain and Cross Compilation: Text Editors/Compilers/Programmers/ Development tools/IDE, Debugger.

Unit – II: ARM Cortex M Processor Core

Introduction to ARM Cortex - M microcontroller and STM32L4 architecture, Programmers Model, Processor Operating States, instruction set, clock configuration etc. Why learn assembly language / Embedded C.

Unit –III: Embedded C Programming

Introduction to Embedded C programming, Storage Classes, Data Types, Controlling program flow, Arrays, Functions, Memory Management, Pointers, Arrays and Pointers, Pointer to Functions and advanced topics on Pointers, Structures and Unions, Data Structures, Linked List, Stacks, Queues, Conditional Compilation, Preprocessor directives, Variable arguments in Functions, bitwise operations and typecasting.

Unit – IV: ARM Cortex Peripherals

ARM Cortex–M (STM32L4) Peripherals GPIOs, Timers / Counter, PWM, Interrupt handling and its programming examples (Timer Based PWM output, System timer (Sys Tick), demonstrating race conditions, booting process, volatile variables etc.). Fixed point computation, need for Floating point Unit (FPU), Coprocessor Access control (CPAC) in System Control Block (SCB).

Unit –V: Interfacing using Embedded Wired /Wireless Communication Protocols

GPIO based interfacing like LED, Joystick, LCD driver, ADC, Sensors following I2C, SPI, CAN Bus, GSM etc protocols. AMBA

Text Books:

1. Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C, Dr. Yeifeng Zhu. ISBN-13: 978-0-9826926-6-0. Publisher: E-Man Press LLC

Reference Books:

1. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach, Dr. Alexander G. Dean ISBN:978-1-911531-03-6.
2. The Designer's Guide to the Cortex-M Processor Family: A Tutorial Approach, Trevor Martin. ISBN-13: 978-0080982960.
3. The Definitive Guide to the ARM Cortex- M0, M3 & M4, Joseph Hiu. ISBN-13: 978-1856179638.

Syllabus for Semester VI, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP6001 **Course: Embedded Systems Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand the evolution, exposure and tool chain utilized for ARM microcontrollers
2. Identify the programming needs of ARM cortex microcontroller in terms of architecture and programmers model.
3. Apply the knowledge of architecture and develop the embedded C based programming skills required for microcontroller
4. Deploy and configure Embedded environment to demonstrate interfacing of peripherals.
5. Design and emulate the analyzed algorithms using the emulator.

Experiments based on following topics:

- Programs based of accessing Storage Classes, Data Types, Arrays, Functions, Pointers and its applications in Embedded C
- Programs based on timers
- programs based on serial communication
- programs based on memory accessing
- Programs based on interrupts.
- Programs based on interfacing of peripheral sensors using ADC, DAC, PWM capture etc.

Syllabus for Semester VI, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT6002 **Course: Waveguides and Antennas**

L: 3Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will be able to

1. Study guided wave propagation.
2. Understand transmission line-based systems and components
3. Compare various types of antennas and related technologies for different applications
4. Analyze radiation types and radiation characteristics of an antenna
5. Design of an antenna array

Unit I

Transmission Lines: Transmission line equations and their solutions. Transmission line parameters, Characteristic impedances, Propagation constant, Attenuation constant, Phase constant, Reflection coefficient and VSWR.Equivalent circuits of transmission lines, Open circuited and short-circuited lines.

Unit II

Waveguides: Waves between parallel planes, TE, TM, & TEM and their characteristics, Attenuation in parallel plane guides wave impedances, TE, TM waves and impossibility of TEM mode in Rectangular waveguide, group velocity, phase velocity, guide wavelength and wave impedances of waveguides

Unit III

Antenna Basics: Scalar and vector potentials, related potentials, field due to a current element, radiated resistance and power for field due to a dipole, Reciprocity theorem applied to antennas, Antenna terminology: Gain, Aperture, Radiation intensity,Directivity, Directive gain, Beam width, Radiation patterns, FBR, Antenna bandwidth.

Unit IV

Antenna Arrays: Concept of antenna arrays, Two element arrays and their directional characteristics, Linear array analysis, Broadside and end fire arrays, Principles of pattern multiplication & their application.Polynomial representation, Binomial arrays, Design of broadcast array for a specific pattern.

Unit V

Special Antennas: Travelling Wave Antenna, Yagi-Uda Arrays, Loop Antenna, Helical Antenna, Log-Periodic Antenna, Micro strip Patch Antenna, Parabolic reflectors, Lens antenna, folded dipole, Turnstile antenna, Horn antenna, Travelling wave antenna, Cassegrain antenna

Text Books

1. Electromagnetic Waves & Radiating Systems: Edward C. Jordan, Keith G. Balman, Prentice Hall
2. Antennas and Wave Propagation - J.D. Kraus, RJ. Marhefka and Ahmad S. Khan. TMH, New Delhi, 4th ed., (Special Indian Edition), 2010
3. Electromagnetic Waves: R.K. Shevgaonkar, Tata McGraw Hill India
4. Antenna Wave Propagation: K.D. Prasad

Reference Books:

1. Modern Antenna Design: Thomas Milligan, Wiley Interscience , IEEE Press
2. Engineering Electromagnetics: Narayana Rao, 3rd ed., Prentice Hall
3. Electromagnetics: David Cheng, Prentice Hall
4. Principles of Electromagnetics: Matthew N. O. Sadiku

Syllabus for Semester VI, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP6002 **Course: Waveguides and Antennas Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course Outcomes

At the end of this course students will be able to

1. Understand measurement techniques for transmission line parameters like impedance, VSWR, and propagation constants.
2. Analyze TE, TM, and TEM wave modes in waveguides.
3. Evaluate antenna radiation patterns, gain, directivity, and beamwidth experimentally.
4. Implement antenna arrays for specific radiation characteristics.
5. Demonstrate the performance of special antennas like Yagi-Uda, Microstrip Patch, and Parabolic Reflectors.

Experiments and Simulations based on following topics:

- Transmission line parameters, Smith Chart, Stub matching.
- Waveguides types and modes of operation
- Antenna Radiation patterns Gain etc
- Concept of Antenna Array and Performance
- Special Antennas and Applications.

Syllabus for Semester VI, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT6003 **Course: Wireless Communication**
L: 3Hrs, T: 0Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand the working principles of the mobile communication systems.
2. Interpret radio wave propagation models for wireless systems.
3. Comprehend modulation schemes and multiple access techniques for wireless environments.
4. Analyze mobile communication systems for improved performance
5. Explore next generation wireless systems

Unit – I:

The Cellular Concepts: Architecture of mobile communication systems, call processing, cellular concepts, Frequency reuse, channel assignment, Hand of strategies interference & system capacity, improving grade of service & capacity in cellular systems.

Unit – II:

Mobile Radio Propagation: Large scale path loss, free space propagation model, propagation effects such as reflection, diffraction, scattering, Link Budget Design using path loss models, Multipath fading

Unit – III:

Modulation Techniques and Multiple Access in Mobile Communication: Quadrature modulation methods, fundamentals of equalization, Diversity Techniques, Narrow band and Wide band systems, Space Division Multiple access and other hybrid multiple access techniques.

Unit – IV:

Wireless Systems: GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, Concept of spread spectrum, Architecture of IS-95 CDMA system, Performance of CDMA System, RAKE Receiver.

Unit –V:

Recent Trends in Wireless Communication: Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Adhoc Network, Features of OFDM, OFDMA, LTE, NOMA, MIMO, Massive MIMO

Text Books:

1. Wireless Communication – Principles and practice: T S. Rappaport, Prentice Hall PTR, 2nd edition, 2007
2. Mobile Communications – Design fundamentals: William C. Y. Lee, John Willey, 2nd Edition, 2010

Reference Books:

1. Wireless digital communication: KamiloFeher, Prentice Hall
2. Mobile Cellular Communication: W. C. Y. Lee, McGraw Hill
3. The Mobile Radio Propagation channel: J.D. Parson, Wiley, 2nd edition

Syllabus for Semester VI, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT6004 **Course: Database Management Systems**

L: 2 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 03**

Course Outcomes

At the end of the course students will be able to

1. Comprehend basic concepts of Database Systems, Architecture and Applications
2. Explain various file organizations, indexing techniques and hashing.
3. Use Structured Query Language (SQL) for database creation and interaction.
4. Analyze query processing and optimization
5. Design a database system.

Unit I: Introduction to database systems and its Design:

Overview, File systems Vs DBMS, Levels of abstraction, Structures of DBMS, Relational model, Relations and Integrity constraints, ER model, Conceptual design using ER model, Functional dependencies, Normalization

Unit II: Relational algebra and SQL

Relational algebra and expressions, SQL query, Nested queries, Aggregate operators, Joins, Views.

Unit III File organization:

Storage media, Record and page formats, File organizations, Indexing, Hashing

Unit IV: Query optimization & evaluation and Concurrency control:

Introduction to query processing, Selection operation, Projection operation, Join operation, Estimating the cost of query. Concepts of transaction, Transactions and schedules, Lock based concurrency control.

Text Books:

1. Database Systems Concepts - Henry Korth& Others, 6th Edition, TMH.
2. Fundamentals of database systems - Elmasiri, Navathe& Gupta, 4th Edition, Pearson Education.

Reference Books

1. Raghu Ramakrishnan and Johannes Gehrke; “Database Management Systems”; Third Edition; Tata McGraw Hill Publication, 2003.
2. C.J. Date; “Database in Depth – Relational Theory for Practitioners”; O`Reilly Media

Syllabus for Semester VI, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP6004 **Course: Database Management Systems Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Use DDL, DML and DCL.
2. Write queries using DQL
3. Use Aggregate, Join and other operators of SQL
4. Implement integrity constraints, views, sequences, indices and synonyms on database.
5. Design optimal database for a given application

Experiments based on:

- Designing a database,
- Creating relations,
- Inserting data into relations.
- Writing queries to search the required data
- Writing queries usingAggregate, Join and other operators of SQL
- Implementing integrity constraints, views, sequences, indices and synonyms on database.

Syllabus for Semester VI, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT6005 – 1 **Course: Speech and Audio Processing (Program Elective – 2)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of the course the students will be able to:

1. Understand the mathematical model of Human Speech production.
2. Extend speech coding to audio compression and its standards.
3. Apply the Wavelet transform as a tool for audio analysis.
4. Analyze the speech signal in time and frequency domain.
5. Explore and implement the speech processing applications.

UNIT-1

Digital speech processing and its applications, production and classification of speech sounds, lossless tube models, digital models for speech signals; Analysis and synthesis of pole-zero speech models, Levinson recursion, lattice synthesis filter.

UNIT-2

Time dependent processing of speech, pitch period estimation, frequency domain pitch estimation; Discrete-time short-time Fourier transform and its application, phase vocoder, channel vocoder.

UNIT-3

Homomorphic speech processing, waveform coders, hybrid coders and vector quantization of speech; Model based coding: Linear predictive, RELP, MELP, CELP; Speech synthesis.

UNIT-4

Principles of speech recognition, spectral distance measures, dynamic time warping, word recognition using phoneme units, hidden Markov models and word recognition, speech recognition systems, speaker recognition.

UNIT-5

Ear physiology, psychoacoustics, perception model and auditory system as filter bank; Filter bank design and modified discrete cosine transform algorithm for audio compression in MP3 and AAC coders; Tree-structured filter banks, multi complementary filter banks; wavelet transform; applications of wavelet signal processing in audio and speech coding.

TEXT BOOKS:

1. L.R. Rabiner and S. W. Schafer, “Digital Processing of Speech Signals”, Pearson Education.
2. Douglas O’Shaughnessy, “Speech Communications: Human & Machine”, 2nd Ed., Wiley India, 2000.
3. L.R Rabinar and R W Jhaung, “Digital Processing of Speech Signals”, 1978, Pearson Education.

REFERENCE BOOKS:

1. Thomas F. Quateri, “Discrete Time Speech Signal Processing: Principles and Practice”, 1st Edition., PE.
2. Ben Gold & Nelson Morgan, “Speech & Audio Signal Processing”, 1st Edition, Wiley

Syllabus for Semester VI, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT6005 – 2 **Course: Introduction to Internet of Things (Program Elective – 2)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand the architectures, scope and example applications of IoT.
2. Explore the linux environment for SBC (Single Board Computer)
3. Use Python-based IDE and debug Python code on the SBC.
4. Interface sensors and actuators with IoT enabled SBC.
5. Design IoT based applications on SBC to address societal problems.

Unit I

Introduction to Internet of Things: Concept and its need, architecture, scope and applications, Overview of Networking and protocols applicable to IoT.

Unit II

Exploring the platforms/ hardware for IoT: Getting Started with Raspberry Pi, Basic functionality of the Raspberry Pi board and its Processor, setting and configuring the board, differentiating Raspberry Pi from other platforms like Arduino, Over-clocking, Component overview.

Project 1: Use your Pi as a desktop PC

Unit III

Introduction to Linux: Implications of an operating system on the behaviour of the Raspberry Pi, Overview of Linux and its terminal command, apt-get-update, apt-get-upgrade, navigating the file system and managing processes, text-based user interface through the shell, overview of graphic user interface.

Project 2: Compilation and Installation of Libraries and packages (GPIO, I2C UART, etc)

Unit IV

Programming the Raspberry Pi: Python: Introduction to Python programming language : Python Programming Environment, Python Expressions, Strings, Functions, Function Arguments, Lists, List Methods, Control Flow, Numpy, PIP (Python Installation Package) and customized libraries.

Project 3: Basic Scripting using Python-based

Project 4: Applications using Python packages

Unit V

Sensors and Actuators (Light Sensors, Ultrasonic, Temperature and humidity,etc) for IoT, Wired and Wireless communication, Communication facilities on Raspberry Pi (I2C, SPI, UART), working with RPi. GPIO library,

Project 5: Set up a Pi ADC/DAC

Project 6: Sensor Interfacing to Pi

Communication Using Raspberry Pi for IoT applications: Wired and Wireless communication, TCP IP configurations, SSH, Putty Terminal usage, Web page applications using Python.

Project 7: Hosting and representation of sensor data on web page

Project 8: Case study and Implementation of Real World application

Text Books:

1. Designing the Internet of Things, *Adrian McEween and Hakim Cassimally, 1st Edition John Wiley and Sons, Ltd.*

Reference Books:

1. Learning of Internet of Things, *Peter Waher, 1st Edition Packet Publishing*.
2. Raspberry Pi 3 : An Introduction to Using Python Scratch, Javascript and more, *Gary Mitnick, CreateSpace Independent Publishing Platform, 2017.*
3. Raspberry Pi for Python Programmers Cookbook, *Tim Cox, Packt Publishing Limited; 2nd Revised edition, 2016.*
4. Raspberry Pi User Guide, *Eben Upton and Gareth Halfacreee, John Wiley & Sons, 2016*

Syllabus for Semester VI, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT6005 – 3 **Course: SystemVerilog**
(Program Elective – 2)

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of the course the students will be able to:

1. Elaborate the fundamentals of SystemVerilog; its syntax and application.
2. Apply randomization techniques for generating test scenarios and checking them in hardware verification.
3. Learn the basics of UVM for building reusable and scalable verification environments.
4. Design combinational and sequential logic circuits in SystemVerilog.
5. Evaluate SystemVerilog design using testbenches, assertions and randomization.

Unit – 1

Introduction to SystemVerilog: Overview, Importance in hardware design and verification, Evolution of Verilog to SystemVerilog, Comparison between Verilog and SystemVerilog.
SystemVerilog Basics: Literals, Data Types, Operators, Arrays, Parameters, Keywords and Constructs, Modules and Ports.

Unit – 2

Procedural Statement and Flow Control: Blocking and Non-blocking assignment, General purpose and specialized procedural blocks, Loops, Break, Continue and Return Statements, Design using always, always_comb, Sensitivity List, Sequential Logic Design Using always_ff for flip-flops and latches, Modeling edge-triggered behavior, Synchronization.

Unit – 3

Combinational and Sequential Logic Design: Basic RTL Design, Combinational Logic Task and Functions.
Modeling Finite State Machines: State Machines in SystemVerilog.

Unit – 4

SystemVerilog for Verification: Testbench Structure in SystemVerilog, Testbench components: stimulus, response checking, and reporting, Assertions and Functional Coverage, Randomization.

Unit – 5

Introduction to UVM: UVM vs traditional testbenches, Basic UVM constructs & classes, design a basic test environment using UVM SystemVerilog verification features.

Text Books:

1) SystemVerilog for Design Second Edition: A Guide to Using SystemVerilog for Hardware Design and Modeling, *Stuart Sutherland, Simon Davidmann, Peter Flake 2nd edition 2006, publisher Springer-Verlag New York Inc.*

2) SystemVerilog for Verification: A Guide to Learning the Testbench Language Features, *Chris Spear, Greg Tumbush, 3rd ed. 2012, Springer*

Reference Books

1) A Practical Guide for SystemVerilogAssertions,*SrikanthVijayaraghavan and MeyyappanRamanathan, 2005 ed., Springer Verlag*
2) Digital Design and Computer Architecture: RISC-V Edition, *David Harris and Sarah Harris, Morgan Kaufmann Publishers In*
3) Verification Methodology Manual for SystemVerilog, *Janick Bergeron, Eduard Cerny, Alan Hunter, Andy Nightingale, Springer-Verlag New York Inc.*

Syllabus for Semester VI, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP6006 **Course: Major Project Phase – I**

L: 0 Hrs, T: 0 Hr, P: 4 Hrs. Per week **Total Credits: 02**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Identify the problem statement through a literature survey for project work for research/industry/society/environment.
2. Justify project idea/concept through effective presentation skills.
3. Develop design strategy and use modern tools to simulate and test the project work.
4. Implement project modules and circuit blocks initial/intermediate versions.
5. Test and validate individual project modules.

The students will carry out following tasks for Major Project Phase – I

1. Survey and study of published literature on the assigned topic
2. Working out a preliminary Approach to the Problem relating to the assigned topic
3. Conducting Analysis/Simulation/Experiment/Design/Feasibility
4. Preparing a Written Report on the Study conducted for presentation to the department
5. Final Seminar, as oral Presentation before a departmental committee

VII Semester

Syllabus for Semester VI, B. Tech. (Electronics and Communication Engineering)

Course Code: HUT6001 **Course: Engineering Economics**

L: 2 Hrs, T: 0 Hr, P: 0Hrs. Per week **Total Credits: 02**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand the basic concepts of engineering economics.
2. Understand and evaluate engineering economic decision making
3. Understand revenue and cost concepts in different market structure for better decision-making.
4. Understand various concepts of money management
5. Review the elements of financial statements and understand the basics of financial markets.

Unit 1: Foundation of Engineering Economics: (6 Hours)

Definition of Economics, basic concepts of Economics (value, goods, wealth, income, savings, utility); definition and scope of engineering economics; **demand and supply:** Laws and elasticity.

Unit 2: Engineering Economic decision: (5 Hours)

Rational decision-making process, Engineer's role in business, types of strategic engineering economic decisions, fundamental principles in engineering economics, methods to evaluate business and engineering projects (Present worth analysis, Annual equivalence analysis, Rate of Return Analysis, Benefit-Cost-Analysis).

Unit 3: Cost and Revenues: (7 Hours)

Revenue concepts: Marginal Revenue, Average revenue, total revenue, operating and non-operating revenue; **Cost concepts:** Marginal cost, Average cost, Sunk cost, Opportunity cost, Recurring cost, Non-recurring cost, Incremental cost, Cash cost, Book costs, life cycle cost, direct and indirect costs. Application of the concepts in business/industry.

Unit 4: Money Management: (4 Hours)

Time value of money; interest – types and formulas; **Inflation:** types, causes, inflation adjusted decisions; Break-even analysis, measures of inflation - Index numbers.

Unit 5: Basic Accounting: **(4 Hours)**

Balance sheet, Income Statement, Ratio analysis, Depreciation. **Financial markets:** Call Money, Treasury Bills, Bond, Stock, Derivatives.

Text Books:

1. Panneerselvam. R., (2020) *Engineering Economics,* PHI learning, private limited, Delhi, 2nded.
2. Park.C., (2018) *Fundamentals of Engineering Economics*, Pearson India Education Services, Pvt. Ltd, 3rd ed.
3. Dewett.K.K. (2006), *Modern Economic Theory*, S. Chand, New Delhi, 2006.
4. Bhole, L.M. and JitendraMahakund (2017), *Financial Institutions and Markets*, Tata McGraw Hill (2007) 6thed.
5. Chandra, Prasanna (2008) *Financial Management: Theory and Practise*, Tata MacGraw Hill Publishing Company Limited, New Delhi

Reference Books:

1. Ahuja H.L., (2017) *Managerial Economics, Analysis of managerial Decision making,* S. Chand and company Limited, New Delhi, 9thed.
2. Dwivedi, D.N., *Managerial Economics*, Vikas Publishing House Pvt. Ltd, Nodia (2015) 8thed.

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP7001 **Course: Computer Networks Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Use simulation tools to configure and analyze network performance.
2. Configure host, server, switches and routers for networking.
3. Configure the network for sharing of resources.
4. Analyze protocols for the computer networking.
5. Design and configure a network using addressing mechanisms and protocols.

Experiments based on following topics:

- Simulate & configure different types of networks using network stimulation tools.
- Configure different devices like routers, host machines for setting up a network
- networking concepts like client-Server and addressing mechanism
- Static and Dynamic Routing

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7002 – 1 **Course: Microwave Theory and Techniques (Program Elective – 3)**

L: 3Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand the basic concepts of microwave engineering and applications.
2. Compare the types of transmission lines and modes of propagation.
3. Explain Design Principles of microwave components and antennas.
4. Analyze the functions of active and passive microwave components.
5. Evaluate microwave parameters by measurement techniques.

Unit –I:

Introduction to Microwaves- History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI/EMC.

Analysis of RF and Microwave Transmission Lines – Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Microstrip line.

Microwave Network Analysis- Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters.

Unit –II:

Passive and Active Microwave Devices-Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, PIN diodes, Microwave Tubes: Klystron, TWT, Magnetron.

Unit – III:

Microwave Design Principles-Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas-Antenna parameters, Planar Antennas, Antenna for ground based systems, Antennas for air borne and satellite borne systems.

Unit –IV:

Microwave Measurements- Power, Frequency, VSWR and Impedance measurement at microwave frequency,Network Analyzer, Spectrum Analyzer and measurement of spectrum of a microwave signal. Measurement of Microwave antenna parameters.

Unit – V:

Applications of Microwave Engineering – Radar block diagram, Radar range equation, CW & FM Modulated radar, MTI & Pulse Doppler Radar, Tracking Radar, Radar Receivers, Radar antenna.

Text Books:

1. MicrowaveCircuits, R. E. Collins, McGraw Hill.
2. MicrowaveCircuits, K. C. Gupta and I. J. Bahl, Artech house.

Reference Books:

1. Microwave device and circuits: Samuel Y. Lio, 3 Edition, PHI.
2. Introduction of radar systems: Skolilik, McGraw hill.
3. Microwave theory and measurement: G. Lance.

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7002 – 3 **Course: VLSI Technology (Program Elective – 3)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of the course the students will be able to:

6. Describe diffusion and ion implantation processes and their role in controlling semiconductor device characteristics.
7. Analyze oxidation kinetics, dielectric materials, and contamination control techniques used in VLSI fabrication.
8. Compare photolithography, e-beam lithography, and advanced lithographic techniques for pattern generation in VLSI circuits.
9. Apply CVD and epitaxial growth methods for the deposition of thin films required in semiconductor manufacturing.
10. Evaluate metallization, plasma processing, etching, and thermal processing techniques used in advanced VLSI fabrication.

Unit I

Solid state diffusion modeling & technology, ion implantation technology & damage annealing, characterization of impurity profiles.

Unit II

Oxidation: Kinetics of Silicon dioxide growth both for thick, thin and ultra thin films. Oxidation techniques in VLSI and ULSI, characterization of oxides films, low k and high k dielectrics for ULSI, Environment for VLSI Technology, Clean room and safety requirements, Wafer cleaning process and wet chemical etching techniques.

Unit III

Lithography: Photolithography, e-beam lithography and newer lithography techniques for VLSI/ ULSI, mask generation.

Unit IV

Chemical vapor deposition techniques: CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitrite and metal films, epitaxial growth of silicon.

Unit V

Metal film deposition: Evaporation and sputtering techniques, failure mechanisms in metal interconnect multilevel metallization schemes. Plasma and rapid thermal processing, PECVD, plasma etching and RIE techniques, RTP techniques for annealing, growth and deposition of various films for use in VLSI

TEXT BOOKS

1. VLSI Technology, S. M. Sze, McGraw Hill, II , 1988

REFERENCE BOOKS

1. VLSI fabrication principles, S. K. Gandhi, "John Wiley, New York",1983
2. ULSI Technology, C. Y. Chang. S. M. Sze, McGraw Hill companies,1996

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7003 – 1 **Course: Smart Antennas (Program Elective – 4)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Understand basic concepts and principles involved in radiation from an antenna.
2. Explore and analyze types of antenna arrays for smart antennas
3. Develop Architecture of smart antenna system
4. Evaluate design, performance parameters and applications of smart antennas.
5. Identify the use of smart antennas for MIMO systems.

Unit I

Fundamental Concepts: Concepts of radiation from Wires and Loops and radiation pattern, Infinitesimal dipole, finite-length dipole, dipoles for mobile communication, Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle.

Unit II

Basic Concepts of Smart Antennas – Concept and benefits of smart antenna, types of smart antennas, Sectorization, Switch beam and adaptive beam antenna systems, Direction-of-Arrival considerations, beam forming, impact of array configuration and geometry on radiation pattern, concept of adaptive antennas and adaptive array algorithm.

Unit III

Smart Antenna Arrays - Introduction to antennas arrays, analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays. Retro-directive arrays, Adaptive arrays, Butler Matrix.

Unit IV

Architecture and Applications: Block diagram of architecture of smart antenna systems, Angle of arrival estimation with various estimation algorithms such as Bartlett AOA

Estimate, Capon AOA Estimate and dsp processor, Applications of smart Antennas for 5G systems, performance improvement, feasibility and system considerations.

Unit V

MIMO Antennas: Basic MIMO antenna system, Multiple antenna MS Design, RAKE Receiver Size, Mutual coupling Effects, Principles of MIMO systems: SISO, SIMO, MISO, MIMO, Hybrid antenna array for mm Wave massive MIMO.

Text Books:

1. J. D. Kraus, Antennas, McGraw Hill, 2nd edition.
2. C. A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 3rd edition.
3. Ahmed EI Zooghby, 'Smart Antenna Engineering' , ARTECH HOUSE, INC, 2005

Reference Books:

1. Lal Chand Godara, 'Smart Antennas' , CRC PRESS, 2004
2. Ahmed El Zooghby, Smart Antenna Engineering, Artech House.
3. Sun, Chen, Cheng, Jun, Ohira, Takashi, Handbook on Advancements in Smart Antenna Technologies for Wireless Networks.
4. Adaptive Antenna Arrays: Trends and Applications by Sathish Chandran.

Syllabus for Semester VII, B0. Tech. (Electronics and Communication Engineering)

Course Code: ECT7003 – 2 **Course: Artificial Intelligence (Program Elective – 4)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes: -

At the end of this course students will demonstrate the ability to

1. Understand uncertainty theory in designing AI systems.
2. Solve AI problems through programming languages.
3. Apply optimization and inference algorithms for modelling.
4. Create agents to learn and act in a structured environment.
5. Build intelligent agents for search and games.

Unit –I:

Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.

Unit – II:

Search Algorithms: Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.

Unit –III:

Probabilistic Reasoning: Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.

Unit – IV:

Markov Decision Process: MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs

Unit –V:

Reinforcement Learning: Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning, Machine Learning Fundamentals**,** Neural Network Fundamentals, Deep Learning Fundamentals**,** Computer Vision Fundamentals, Future of AI.

Text Books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , 3rd Edition, Prentice Hall
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill

Reference Books:

1. Trivedi, M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, Delhi.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011
3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7003 – 3 **Course: Fundamentals of Physical Design (Program Elective – 4)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Describe the VLSI design flow and styles
2. Use algorithmic graph theory and combinatorial optimization techniques to formulate and solve VLSI design problems
3. Explain the algorithms for partitioning, floor planning, placement and routing
4. Describe the process of Static Timing Analysis of VLSI circuits.
5. Implement low power physical design.

Unit – I:

Introduction to VLSI CAD : VLSI design methodologies, use of VLSI CAD tools, Algorithmic GraphTheory and computational Complexity.

High-level Synthesis : Hardware Models for High-level Synthesis, Internal Representation of the InputAlgorithm, and Understanding RTL to Gate Level design mapping. Basic concept of Static TimingAnalysis (STA).

Unit – II:

Partitioning : Introduction, Types of Partitioning, Classification of partitioning Algorithm, KLalgorithm.

Floor-planning : Introduction, Sliced and non-sliced planning, Polish expression, Power planning, IOPlanning

Unit – III:

Placement : Introduction, classification of placement algorithms, partition based placement, timing /congestion aware Placement

Unit – IV:

Clock Tree Synthesis: Different topologies of Clock Tree Structure. Overview on Clock Meshimplementation for High Performance designs.Routing: Fundamental Concepts of Steiner trees, Twophases of Routing: Global routing & detailed routing, Routing Algorithms

Unit – V:

Low Power Physical Design: Understanding Various Power Optimization algorithms (dynamic andLeakage), Overview on implementation and complexities involved in low power PD.

SOC Physical Design: Re-convergent model of VLSI SOC Design, SOC Physical design, advancedphysical design of SOCs.

Text books

1. VLSI Physical Design Automation: Theory and Practice: Sadiq M. Sait, Habib Youssef, McGraw-Hill 2004.
2. VLSI Physical Design: From Graph Partitioning to Timing Closure: Jin Hu, Jens Lienig, Igor L. Markov, Andrew B. Kahng, Springer, Dordrecht 2011.
3. Handbook of Algorithms for Physical Design Automation: Charles J Alpert, Dinesh P Mehta, Sachin S Sapatnekar, CRC Press, 2008.
4. A Practical Approach to VLSI System on Chip (SoC) Design, Veena Chakravarthi, Springer International Publishing 2020

Reference books

1. Physical Design Essentials: An ASIC Design Implementation Perspective: Khosrow Golshan, Springer, (2007)
2. Static Timing Analysis for Nanometer Designs: A Practical Approach: J. Bhasker and Rakesh Chadha, Springer, (2009).
3. Practical Problems in VLSI Physical Design Automation, Sung Kyu Lim, Springer, (2008), ISBN 978-1402066269
4. Algorithms for VLSI Design Automation: Sabih H. Gerez and John Wiley,(1998).
5. An Introduction to VLSI Physical Design: Majid Sarrafzadeh and C. K. Wong, McGraw Hill, (1996).
6. Algorithms for VLSI Physical Design Automation: Naveed Sherwani, Kluwer Academic Pub., (1999).

Syllabus for Semester VIII, B.Tech. (Electronics and Communication Engineering)

Course Code: ECT7004 – 1 **Course: Optical and Satellite Communication (Program Elective – 5)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

On completion of this course students will be able to understand:

1. Recent advancements in fiber optics, its working principle and its applications.
2. Splicing techniques, couplers, connectors and losses in OFC systems.
3. The principle of operation of optical sources and detectors and its parameter consideration while designing particular system.
4. Satellites subsystems & launching.
5. Link designing problems and finding engineering solution.

Unit – I

Principle of optical fiber communication, Advantages and applications, Ray model, Total internal reflection phenomenon, Acceptance angle, acceptance cone, Numerical aperture, Structures and characteristics of various fibers such as step index, graded index, Single mode and multi mode fibers, Meridional and skew rays.

Unit – II

Fiber joints, splices and connectors and couplers.Signal degradation in fibers – Attenuation, dispersion, bending losses, scattering losses, Absorption losses, propagation losses.

Unit – III

Optical sources – LEDand LASER, Structures and properties, Source launching and coupling.

Photo detector – PIN and Avalanche Photo-detectors, Structures and Properties, Optical receiver.

Unit-IV

Introduction, Origin of satellite communication, Current state of satellite communication, General features, Satellite Frequency bands allocation

Introduction to Keplers laws, Orbital dynamics, Orbital characteristics, Satellite spacing and orbital capacity, Angle of Elevation eclipses, Launching and positioning

Unit V

Satellite construction (Space segment), Attitude and orbit control system, Telemetry, Tracking and command, Power systems, Communication sub-systems, Antenna sub-systems, Satellite transponder,Earth station subsystems, different types of earth stations.

Satellite links: Introduction to general link design equation, System noise temperature, Satellite uplink & downlink design and analysis.

Text Books:

1) Optical fiber communication, principles and practice: *John M. Senior, PHI*
2) Optical fiber communication: *B. Keiser, Tata Mc-Graw Hill*
3) Satellite Communication: *T. Pratt*
4) Satellite Communication: *Dennis Roddy*

Reference Books

1) Optical communication system: *J. Gower, PHI.*
2) Optical Fiber System :*Kao, Tata Mc Graw Hill*
3) Satellite communication Systems – Design Principles: *M. Richaria,*
4) Satellite communication Systems engineering: *Wilbur L. Pritchars, Henri G Suyder and Robert A. Nelson, Pearson Education Ltd*

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7004 – 2 **Course: Digital Image Processing (Program Elective – 5)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand fundamentals of acquisition, representations and pixel operations of digital Image.
2. Apply image transforms for analysis and compression.
3. Perform image processing operations for enhancement and inspection.
4. Perform segmentation, filtering and de-noising on image.
5. Develop Image processing applications.

Unit –I:

Fundamentals of Image processing: Introduction & Applications, Elements of visual perception, Image sensing and acquisition, simple image formation, Image sampling and Quantization, Representing digital pixels, Basic relationship between pixels, Image quality, Introduction to colour image – RGB and HSI Models.

Unit – II:

Image Transforms: General 2 –D Image transform relation, Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Sine Transform (DST), Discrete Wavelet transforms.

Unit – III:

Image Processing Techniques: Image Enhancement, Spatial Domain methods- Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency Domain methods- Basics of filtering in frequency domain, image smoothing, imagesharpening, selective filtering.

Unit –IV:

Image Segmentation- Segmentation concepts, point, line and Edge detection, Thresholding methods, Region based segmentation.Representation and description –Representation, boundary descriptors,Regionaldescriptors,Edge linking and boundary detection,

Unit – V:

Image Compression: Image compression fundamentals –coding Redundancy, spatial and temporal redundancy. Compression models- Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards

Text Books:

1) Digital image processing: *Rafel C. Gonzalez and Richard E. Woods, Addition-wisely*
2) Fundamental of digital image processing: *Anil K. Jain, PHI*

Reference Books:

1) Image Processing, Analysis and Machine Vision: *Milan Sonka, Vaclav Hlavac and Roger Boyle.*
2) Digital picture processing: *Rosenfeld A.C. Kak, academic press inc 1976.*
3) Computer image processing and recognition: *Hall E.L., academic press inc 1979.*
4) Picture processing and digital filtering: *Huang T.S., Springer Verlag, Berlin Heidelberg.*

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7004 – 3 **Course: VLSI Signal Processing**
(Program Elective – 5)

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Explain the basic understanding of discrete signals and systems
2. Apply the pipelining and parallel processing techniques
3. Re-Design the DSP systems for the given constraints using retiming techniques
4. Fold and unfold the DSP systems.
5. Analyze data flow in systolic architectures

Unit I

Introduction to Digital Signal Processing (DSP) systems, sampling theorem, discrete time signal & systems, representation of discrete systems in Z domain, basic DSP algorithms and its mathematical representation, representation of DSP algorithms using block diagram, data flow graph, dependence graph, signal flow graph, Loop bound and Iteration bound algorithms, difference between recursive(IIR) and non-recursive (FIR) systems

Unit II

Basics of pipelining and parallel processing, cut-set theory, data broadcast structure and transpose structure of FIR systems, fine-grain and course-grain pipelining techniques, realizing a parallel architecture for FIR systems, pipelining and parallel processing for low power.

Unit III

Retiming algorithm for IIR systems, cut set retiming and pipelining, retiming for clock period minimization, retiming for register minimization.

Unit IV

Unfolding algorithms, properties, unfolding for sample period reduction, word level processing, bit level processing, register minimization techniques using folding transformation

Unit V

Folding algorithms, properties, register minimization techniques using folding transformation, systolic architecture design, block diagram, space representation, edge mapping table, low level implementations, space time representation for systolic arrays.

Text Books:

1. VLSI Digital Signal Processing Systems, Keshab K. Parhi, A Wiley-Interscience Publication, 1999

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7005 **Course: Control Systems**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand feedback control systems.
2. Determine transfer function of a system.
3. Apply mathematical and graphical tool(s) to perform the stability analysis of the system.
4. Analyze systems in time domain.
5. Analyze systems in frequency domain.

Unit I

Introduction to need for automation and automatic control, use of feedback, Board spectrum of system application, Transfer Functions, block diagram, signal flow graphs, analysis of parameter variation, Control system components.

Unit II

Time response of system, Types and order of system, Standard input, concept of gain and time constants, Steady State error, Time response specifications, approximate methods for higher order system, Introduction to controllers.

Unit III

Stability of control systems, conditions of stability, characteristic equation, Routh's – Hurwitz criterion, special cases for determining relative stability.

Unit IV

Elementary idea of Root Locus, Stability analysis using root locus, effect of adding pole and zero and proximity of imaginary axis.

Unit V

Frequency response method of analyzing linear system, Bode plot, Polar Plot, Nyquist criterion, Stability and accuracy analysis from frequency response.

Text Books:

1. Control systems Engineering: I. J. Nagrath and M. Gopal, 5th Edition, New Age International Limited, Publishers (Formerly Wiley Eastern Limited)
2. Modern Control Engineering: Katsihiko Ogata -3e - Prentice -Hall of India

Reference Books:

1. Introduction to Feedback Control: Li Qui and Kemin Zhou, Pearson Education.
2. Control Systems – Principles and Design: M. Gopal, 3rd Edition, Tata McGraw Hill Education Private Limited, New Delhi.

Syllabus for Semester VII, B. E. (Electronics and Communication Engineering)

Course Code: ECT7006 Course: System Software and Operating Systems

L: 2 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 02

Course Outcomes:

On successful completion of the course, students will be able to:

1. Explain the concepts, functions and services of Operating Systems.
2. Analyze Process Management Techniques, Scheduling algorithms and Multithreading concepts.
3. Apply synchronization mechanisms to manage process/thread coordination.
4. Analyze and evaluate deadlock handling techniques for efficient resource management in operating systems.
5. Illustrate memory management schemes including paging, segmentation and virtual memory.

Unit I:

Introduction: Evolution of OS, Types of OS, services provided by OS, system calls, Overview of OS structure, Role of System Software – Assemblers, Compilers, Loaders and Linkers.

Unit II:

Process Management: Process concept, Process control block, Scheduling, Multithreading model, scheduling algorithms.

Unit III:

Process synchronization and Deadlocks: Concurrency conditions**,** Critical section problem, Semaphores, monitors, Classical Synchronization Problems.

Deadlocks: Deadlock characterization, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection

Unit IV:

Memory and File management: Basics of Memory Management, Swapping, Paging, Segmentation, Virtual memory, Page replacement, Page replacement algorithms, File Systems, Disk Scheduling Basics.

Text Books:

1. *Operating System concepts*: Silberchatz and Galvin, 6thEdition, John Wiley and Sons, 2001.
2. *Modern Operating Systems*: Tanenbaum, 2ndEdition, PHI, 2001.

Reference Books:

1. *Operating System*: Milan Milenkovik, 2nd Edition, Tata McGraw Hill 1997.

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code:ECP7007 **Course: Major Project Phase 2**

L: 0 Hrs, T: 0 Hr, P: 4 Hrs. Per week **Total Credits: 02**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Implement project modules and circuit blocks initial/intermediate versions.
2. Test and validate individual project modules.
3. Integrate hardware and/or software modules for identified problems.
4. Lab-test and validate the modules of implemented project system.
5. Field-test the implemented system and summarize through presentation skills, publication and report writing.

The students will carry out following tasks for Major Project Phase 2

1. In depth study of the topic assigned in the light of the Report prepared under Project Stage-I
2. Review and finalization of the Approach to the Problem relating to the assigned topic
3. Preparing an Action Plan for conducting the investigation, including teamwork
4. Detailed Analysis//Simulation/Design/Problem Solving/Experiment as needed
5. Final development of product/process, testing, results, conclusions and future directions
6. Preparing a paper for Conference presentation/Publication in Journals, if possible
7. Preparing a Dissertation in the standard format for being evaluated by the Department
8. Final Seminar Presentation before a Departmental Committee

VIII Semester

Syllabus for Semester VIII, B. Tech. (Electronics and Communication Engineering)

Course Code:ECT8001 – 1 **Course: Wireless Sensor Networks (Program Elective – 6)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand sensor networks and types of Wireless Sensor Networks (WSN)
2. Comprehend Routing and MAC protocols for different communication standards used in WSN
3. Explore new protocols for WSN.
4. Analyze the performance of Mobile Ad-hoc Networks (MANETs) and WSN.
5. Conduct case study of wireless sensor networks for a given application.

Unit –I:

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks.

Unit – II:

Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks, Issues and challenges in wireless sensor networks.

Unit –III:

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee,

Unit – IV:

Dissemination protocol for large sensor network, Data dissemination, data gathering and data fusion, Quality of a sensor network, Real-time traffic support and security protocols.

Unit –V:

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication, Single-node architecture, Hardware

components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Text Books:

1. Waltenegus Dargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks Theory and Practice”, By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009

Reference Books:

1. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004
2. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science
3. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009

Syllabus for Semester VIII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT8001 – 2	**Course: Deep Learning (Program Elective – 6)**
L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week	**Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Apply fully connected deep neural networks to real-world problem-solving scenarios.
2. Evaluate the performance of various deep learning models in terms of optimization, bias-variance trade-off, overfitting, and underfitting.
3. Analyze the role of convolutional and recurrent neural networks in addressing different real-world problems.
4. Create advanced deep learning models by designing variants of CNNs and RNNs tailored to specific applications

UNIT I:

Basics of Deep Learning: History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons,, Perceptron Learning Algorithm and Convergence, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons.

UNIT II:

Training of Feedforward Neural Networks: Feedforward Neural Networks, Representation Power of Feedforward Neural Networks, Training of Feedforward Neural Networks, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam

UNIT III:

Optimization Algorithm: Activation Function and Initialization Methods: Sigmoid, Tanh, ReLU, Xavier and He Initialization, Regularization: Bias and Variance, Overfitting, Hyperparameters Tuning, L1 and L2 Regularization, Data Augmentation and Early Stopping, Parameter Sharing and Tying.

UNIT IV:

Convolutional Neural Network (CNN): Convolutional Neural Networks, 1D and 2D Convolution, Visualizing Convolutional Neural Networks, Guided Backpropagation.

UNIT V:

Recurrent Neural Network (RNN): Recurrent Neural Networks, Backpropagation Through Time (BPTT), Vanishing and Exploding Gradients, Long Short-Term Memory (LSTM) Cells, Gated Recurrent Units (GRUs), Variants of CNN and RNN Encoder-Decoder Models, Attention Mechanism, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet.

Text Books:

1. Sandro Skansi, Introduction to Deep Learning, Springer
2. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer, 2019
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016
4. Dr. S. Lovelyn Rose, Dr. L. Ashok Kumar, Dr. D. Karthika Renuka, Deep Learning using Python, Wiley Publication

Reference Books:

1. Bishop, C. M., Pattern Recognition and Machine Learning, Springer, 2006
2. Yegnanarayana, B., Artificial Neural Networks, PHI Learning Pvt. Ltd., 2009
3. A. Ravindran, K. M. Ragsdell, and G. V. Reklaitis, Engineering Optimization: Methods and Applications, John Wiley & Sons, Inc., 2016

Syllabus for Semester VIII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT8002 – 1 **Course: 5G and Next Generation Communication Systems (Program Elective – 7)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course, students will demonstrate the ability to

1. Understand the evolution from 1G to 5G and key features of 5G
2. Interpret 5G architecture and New Radio (NR) concepts to describe functional, physical, and protocol-level operations in real-world deployment scenarios
3. Analyze MTC and D2D communication techniques in 5G
4. Evaluate spectrum management and bandwidth optimization in 5G
5. Conceptualize future communication solutions beyond 5G

Unit I

Foundations of 5G Networks: Evolution from 1G to 5G and key technological milestones, Benefits and limitations of 5G compared to earlier generations, Global standards and organizations shaping 5G development, 5G Use cases

Unit II

5G Architecture: Basics about RAN architecture, 5G New Radio Access Technology; 5G NR Global view; NR- Physical Layer: Radio Protocol Architecture, Functional architecture, 5G flexibility, Physical architecture and 5G deployment

Unit III

Machine Type Communication and Device-to-Device Communication: Use cases and categorization of MTC, MTC requirements; Fundamental techniques for MTC: Data and control for short packets, non-orthogonal access protocols; Massive MTC, D2D: from 4G to 5G,Radio resource management for mobile broadband D2D

Unit IV

Spectrum and Bandwidth Management: Spectrum challenges in 5G, Spectrum allocation strategies for 5G deployment, High, mid and low band frequencies and their use cases, Bandwidth optimization techniques for high-performance networks, Regulatory and policy frameworks for spectrum management

Unit V

Beyond 5G – Emerging Technologies: Early research and vision for 6G communication systems, Integration of Satellite and non-terrestrial networks, Potential of quantum communication in future networks, Trends shaping evolution of global communication.

TEXT BOOKS:

1. AfifOsseiran, Jose F Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016
2. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies", CRC Press, Taylor & Francis Group, First Edition, 2018
3. HarriHolma, Antti Toskala, Takehiro Nakamura, "5G Technology 3GPP NEW RADIO", John Wiley & Sons, First Edition,2020

REFERENCE BOOKS:

1. Ali Zaidi, Fredrik Athley, Jonas Medbo, Ulf Gustavsson, Giuseppe Durisi, Xiaoming Chen, "5G Physical Layer, Principles, Models and Technology, Components, Academic Press, 2018.
2. Saad Z. Asif, "5G Mobile Communications: Concepts and Technologies", CRC Press, 2019.

Syllabus for Semester VIII, B.Tech. (Electronics and Communication Engineering)

Course Code: ECT8002 – 2 **Course: Networks and Systems Security (Program Elective – 7)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

At the end of this course, students will be able to:

1. Explain security goals, threat models, and fundamental cryptographic concepts used in modern information security.
2. Analyze network security mechanisms and protocols for secure communication.
3. Examine system-level vulnerabilities, attacks, and corresponding defense techniques.
4. Evaluate security challenges in emerging technologies such as IoT, cloud, and cyber-physical systems.
5. Apply security concepts to real-world domains including critical infrastructure, mobile, and wireless systems.

Unit – I:

Advanced Cryptographic Concepts and Security Foundations: Security goals and threat models, review of symmetric and asymmetric cryptography, hashing and digital signatures, advanced cryptographic concepts, limitations of classical approaches, introduction to modern cryptographic applications.

Unit – II:

Network Security: Key distribution, access control, transport layer security (HTTPS, SSH), wireless network security, electronic mail security, Internet Protocol Security (IPSec), virtual private networks (VPN), firewalls, and network intrusion detection systems.

Unit – III:

System Security: Malware, program analysis, penetration testing, common injection attacks (command injection, SQL injection, cross-site scripting), defense mechanisms, embedded system and hardware security.

Unit – IV:

Security of Emerging Technologies: Software-defined networking security, cloud security, security of Internet of Things, cyber-physical systems security, anonymous communication networks, peer-to-peer communication and digital payments, introduction to adversarial machine learning.

Unit – V:

Applied and Operational Security: Critical infrastructure security, ICS/SCADA, IT vs OT, basics of automotive and mobile security, wireless security concepts including IEEE 802.11i and WEP/WPA, and introduction to security practices such as ethical hacking and machine learning in cybersecurity.

Text Books:

1. Cryptography & Network Security: Behrouz A. Forouzan, Debdeep Mukhopadhyay, 3rd Edition MGH.
2. Computer and Information Security Handbook: John R Vacca, 3rd Edition MK.

Reference Books:

1. Cryptography and Network Security: William Stallings, Fifth Edition Pearson.
2. Network Security Essentials, Applications and Standards, William Stallings, Sixth Edition Pearson.
3. Industrial Cybersecurity: Efficiently Securing Critical Infrastructure Systems

Syllabus for Semester VIII, B. Tech. (Electronics and Communication Engineering)

Course Code:ECT8002 – 3 **Course: RF Circuit Design (Program Elective – 7)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to:

1. Understand the behavior of active and passive components at radio frequency
2. Implement filter in radio frequency domain.
3. Analyze active RF Component and analog communication circuits
4. Design Circuits, Dimensions and units in RF frequency spectrum.
5. Design Microstrip Transmission Lines and its analysis.

Unit I

Importance of radio frequency design, frequency spectrum, RF behavior of passive components: High frequency resistors, capacitors & inductors, Chip components and Circuit board considerations: Chip resistors, chip capacitors, surface mounted inductors, Examples of transmission Lines.

Unit II

The Smith Chart- Reflection coefficient in Phasor form, Normalized Impedance equation, Parametric reflection coefficient equation, graphical representation, Impedance transformation for general load, Standing wave ratio, Special transformation conditions, Admittance Transformations

Unit III

RF Filter Design: Filter types and parameters, Low pass filter, High pass filter, Bandpass and bandstop filter, Insertion Loss, Special Filter Realizations: Butterworth type filter, Chebyshev type filters, Denormalization of standard low pass design, Filter Implementation: Unit Elements, Kuroda's Identities and Examples of Microstrip Filter Design.

Unit IV

Active RF Components and Biasing Networks, Device parameters and their impact on circuit performance, Matching Network, Microstrip lines Matching Network: From discrete component to Microstrip line, Stub Matching Networks

Unit V

RF transistor amplifier Characteristics, Power relations, Stability considerations, Gain, Noise figure, Broadband, High power multistage amplifiers, Analog communication circuits, Recent Trends/Developments.

Text Books:

1. RF Circuit Design: Reinhold Ludwig, Pavel Bretchko, Pearson Education Asia.
2. The Design of CMOS Radio Frequency Integrated Circuits: Thomas H. Lee-Cambridge University Pres

Reference Books:

1) RF Microelectronics: Behzad Razavi-McGraw Hill.
2) Design of Analog CMOS integrated circuits: Behzad Razavi- McGraw Hill.

Syllabus for Semester VIII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP8003 **Course: Project**

L: 0 Hrs, T: 0 Hr, P: 12 Hrs. Per week **Total Credits: 06**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Implement project modules and circuit blocks initial/intermediate versions.
2. Test and validate individual project modules.
3. Integrate hardware and/or software modules for identified problems.
4. Lab-test and validate the modules of implemented project system.
5. Field-test the implemented system and summarize through presentation skills, publication and report writing.

The students will carry out following tasks for Project

1. IndepthstudyofthetopicassignedinthelightoftheReportpreparedunder Project Stage-I
2. ReviewandfinalizationoftheApproachtotheProblemrelatingtotheassignedtopic
3. PreparinganActionPlanforconductingtheinvestigation,includingteamwork
4. DetailedAnalysis//Simulation/Design/ProblemSolving/Experimentasneeded
5. Finaldevelopmentofproduct/process,testing,results,conclusionsandfuturedirections
6. PreparingapaperforConferencepresentation/PublicationinJournals,ifpossible
7. PreparingaDissertationinthestandardformatforbeingevaluatedbytheDepartment
8. FinalSeminarPresentationbeforeaDepartmentalCommittee

Syllabus for Semester VIII, B. Tech. (Electronics and Communication Engineering)

Course Code:ECP8004 Course: Full SemesterIndustryInternship

L: 0 Hrs, T: 0 Hr, P: 24 Hrs. Per week Total Credits: 12

- The internship scheme will be available to undergraduate students of the department during the VII/VIII Semester.
- This scheme will provide students to undergo internship with stream majors at industry/well known academic institutions /R&D Laboratory premises and earn real world exposure.
- The student will be relieved for his/her internship at the start of the VII/VIII semester. Such students will appear for End Semester Examination along with other regular students of VIII semester as per the time-table provided by the institute.
- The evaluation will be done by industry mentor in coordination with the department.
- The head of department will assign a Mentor Faculty for a group comprising maximum four students each. The mentor faculty will also act as the Internal Supervisor for their respective projects in the industry.
- This internship scheme during VII/VIII Semester shall be offered subject to fulfillment of selection criteria by the student as decided by the department, grant of permission by industry /organization where internship is to be carried out, approval by head of department, availability of faculty and other requirements/constraints if any.
- On selection, it will be mandatory for the student to abide by the guidelines issued by department and the industry regarding internship.
- On completion, the student has to submit the internship report/s and internship completion certificate/s issued by the organization(s) where it was completed, to the department.
- The department will evaluate the same by way of Seminar/Viva-voce etc. in the department during VII/VIII Semester.

HONORS COURSES

Syllabus for Semester III, B. Tech.
(Electronics and Communication Engineering – HONORS)

Course Code: ECTH3100 **Course: Communication System Analysis (HONORS Course)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

After completion of this course, the students will be able to:

1. Describe the basic building blocks of communication systems.
2. Explain the concepts of advanced communication systems.
3. Apply convolution techniques in the context of communication signals
4. Demonstrate the application of software-defined radio (SDR) and cognitive radio in modern communication systems
5. Analyze the performance benefits of using spread spectrum techniques in communication systems

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Unit 1:

Introduction to Communication Systems

Basic building blocks of communication systems, overview of Analog and Digital communication systems, channel types, channel capacity, modeling, noise, performance indices.

Unit 2:

Signal Analysis

Applications of Fourier Transform, Properties, Autocorrelation, Energy Spectral Density, Convolution, Random Variables, Probability Density Functions in communication systems.

Unit 3:

Introduction to Wireless Communication

Basics of Cellular Systems, Wireless Channel Models, Large Scale Fading, Small Scale fading, Error Performance in AWGN and Fading channel, Multiple Access techniques.

Unit 4:

Spread Spectrum Communication Systems

Spreading sequences, Properties of Spreading Sequences, Pseudo- noise sequence, Orthogonal Sequences, Types of spread spectrum systems, probability of error.

Unit 5:

Modern Communication Systems

Introduction to 5G and Beyond, MIMO Systems and Spatial Diversity, Software-Defined Radio (SDR), Cognitive Radio, Communication System Security and Privacy

Textbooks

1. "Communication Systems" by Simon Haykin, 4th Edition, Wiley Publications
2. "Digital Communication" by John G. Proakis, McGraw Hill Publications
3. "Modern Wireless Communication" by K. Sam Shanmugan

Reference books:

1. Ke-Lin Du & M N S Swamy, "Wireless Communication System", Cambridge University Press, 2010
2. Behrouz A Forouzan, "Data Communications and Networking", 4th Edition, McGraw Hill.
3. William H. Tranter, K. Sam Shanmugan, T. S Rappaport, Kurt L. Kosbar, Principles of Communication System Simulation with Wireless Applications, 2011, 1st Edition, Prentice Hall Press, USA

Syllabus for Semester IV, B. Tech.
(Electronics and Communication Engineering – HONORS)

Course Code: ECTH4100 **Course: Multimedia Networks (HONORS Course)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

After completion of this course, the students will be able to understand:

1. Functioning of circuit switched and packet switched networks
2. Reasons for emergence of converged communication networks
3. Various media coding algorithms and their applications
4. Emerging trends in multimedia networks.

Unit I
Review of circuit switched digital telephony, signaling and transmission, ISDN, SS7. Evolution of packet switched networks, Internet and LANs. The TCP/IP protocol stack.

Unit II
Introduction to XoIP, network convergence, Needs of individual users, enterprises and network operators. How XoIP is expected to meet all these concerns.

Unit III
Source coding (speech, audio and video coding) PCM, ADPCM, LP coding, CELP, RPE-LTP, adaptive sub-band coding, MPEG standards for audio and video coding.

Unit IV
Signaling protocols: Review of H.323, MEGACO protocols, Session Initiation Protocol (SIP), detailed study of SIP, implementation of SIP through Java.
Media Transport: Need of special media transport protocols, RTP, RTCP, RTSP, QoS issues, routing, security etc.

Unit V
Modern network technologies: Mobile communication 3G, 4G, IMS, wireless LANs, wired networks. New services like IP-TV, multimedia conference calls, presence management, device and access independent services. VXML based applications

Text Books:

1) O. Hersent, D. Gurle and JP Petit- "IP Telephony", Pearson Education Asia.
2) J. D. Gibson (Editor) "Multimedia Communications" – Harcourt India.

Reference Books:

1) Bill Douskalis "IP Telephony", Prentice Hall.
2) R. Wittman, M.Zitterbart-Morgan Kaufman, "Multicast Communication".

Syllabus for Semester V, B. Tech.
(Electronics and Communication Engineering – HONORS)

Course Code: ECTH5100 **Course: Cryptography and Information Security (HONORS Course)**

L: 4 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 04**

Course Objectives

The objective of this course is to make students aware of:

1. Basic concepts of Cryptography and Symmetric ciphers.
2. Security at different OSI layers.
3. Survey role of software in Information Security and defense mechanism against the attacks.
4. Access enforcement of security policies based upon leading standards of Information Security.

Course outcomes

After completion of this course, the students will be able to understand:

1. Fundamental concepts of Symmetric and Asymmetric Key Cryptography.
2. Various standard security protocols.
3. Different types of attacks and defenses against them.
4. How to write and enforce security policies based upon leading standards of Information Security.

Prerequisites – Computer Network (ECT357)

Unit I
Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Hashing and Digital Signatures, Symmetric ciphers and systems: Block and Stream, DES, AES.

Unit II
Security at different OSI layers: Physical Layer: Separated Networks, Data Diode; Application layer: PGP or S/MIME; Network layer: IPSec; Transport layer: SSL & TLS

Unit III
Introduction to Software and System Security: Buffer overflow and malicious software, Intrusion detection system, Firewall, DMZ. Common security problems including memory corruption, integer overflows, various injection attacks (command injection, SQL injection, XSS), Techniques to prevent and detect problems concerning software security.

Unit IV
Organizational Security: Information Technology and Security Management, Standards: ISO27001/ ISO27002/ISO27005, Risk Management

Unit V

Economics of Information Security: Rationality in behavior, Incentives and Externalities, Tragedy of commons, Market of lemons, Human factor in Information Security: Social Engineering/Phishing Campaigns

Unit VI

Future Verticals of Information Security:
Operational Security: Introduction to Critical Infrastructure Security, ICS/SCADA, IT VS OT.
Automotive Security: Overview of In-Vehicle Architecture, Threat Landscape, Security Mechanisms.
Mobile Security: Radio Access Network Security, Introduction to 2G/3G/4G security.
Wi-Fi Security: Open Access vs Private Network, IEEE802.11i WLAN, WEP/WPA Security.
*Recent Trends: Introduction to -Ethical Hacking/ Blockchain /Machine Learning in Cybersecurity

Text Books:

1) Cryptography & Network Security: Behrouz A. Forouzan, Debdeep Mukhopadhyay, 3rd Edition MGH.
2) Computer and Information Security Handbook: John R Vacca, 3rd Edition MK.

Reference Books:

1. Cryptography and Network Security: William Stallings, Fifth Edition Pearson.
2. Industrial Cybersecurity: Efficiently secure Critical Infrastructure security

Syllabus for Semester VI, B. Tech.
(Electronics and Communication Engineering – HONORS)

Course Code: ECTH6100 **Course: Evolution of Air Interface towards 5G (HONORS Course)**

L: 4 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 04**

Course Objectives

The objective of this course is to make students aware of:

1. Understand about the 5G radio access methodologies and spectrum
2. Comprehend about 5G architecture
3. Know millimeter wave technology
4. Gain knowledge about the features of 5G Technology

Course outcomes

After completion of this course students will be able to understand:

1. Describe the evolution of 5G, system concepts and spectrum challenges
2. Illustrate the architecture, Beamforming and hardware technologies for mmW communications
3. Describe and explain the requirements and fundamental techniques for MTC and D2D Communication
4. Illustrate and explain the fundamentals, resource allocation and transceiver algorithms for Massive MIMO

Prerequisite: Wireless Communication (ECT355 – 3)

Unit I

OVERVIEW OF 5G COMMUNICATION TECHNOLOGY

Historical Trend for Wireless Communication - Mobile Communications Generations: 1G to 4G – Evolution of LTE Technology to Beyond 4G – Standardization Activities -Use cases and Requirements – System Concept – Spectrum and Regulations: Spectrum for 4G – Spectrum Challenges in 5G – Spectrum Landscape and Requirements – Spectrum Access Modes and Sharing Scenarios

UNIT II

5G ARCHITECTURE AND MILLIMETER WAVE COMMUNICATION

5G Architecture: Software Defined Networking – Network Function Virtualization – Basics about RAN Architecture –High-Level Requirements for 5G Architecture – Functional Architecture and 5G Flexibility – Physical Architecture and 5G Deployment

UNIT III

MILLIMETER WAVE COMMUNICATION

Millimeter Wave Communication: Channel Propagation – Hardware Technologies for mmW Systems – Deployment Scenarios – Architecture and Mobility – Beamforming – Physical layer Techniques

UNIT IV

MACHINE TYPE AND D2D COMMUNICATION

MTC: Use cases and Categorization – MTC Requirements – Fundamental Techniques for MTC – Massive MTC –from 4G to 5G – Radio Resource Management for Mobile Broadband D2D – Multi-operator D2D Communication

UNIT V

5G RADIO ACCESS TECHNOLOGIES

Access Design Principles for Multi-user Communications – Multi-carrier with Filtering – Nonorthogonal Schemes for Efficient Multiple Access – Radio Access for Dense Deployments – Radio Access for V2X Communication – Radio Access for Massive Machine-type Communication.

UNIT VI

MASSIVE MULTIPLE-INPUT MULTIPLE –OUTPUT SYSTEMS

MIMO in LTE – Single-user MIMO – Multi-user MIMO – Capacity of Massive MIMO – Pilot Design of Massive MIMO – Resource Allocation and Transceiver Algorithms for Massive MIMO – Fundamentals of Baseband and RF Implementation in Massive MIMO – Channel Models

Text Books:

1. Fundamentals of 5G Mobile Networks, Publisher(s): Wiley, ISBN: 9781118867525
2. Asif Oseiran, Jose F. Monserrat and Patrick Marsch, “5G Mobile and Wireless Communications Technology”, Cambridge University Press, 2016.

Reference Books:

1. Jonathan Rodriquez, “Fundamentals of 5G Mobile Networks”, Wiley, 2015
2. Patrick Marsch, Omer Bulakci, Olav Queseth and Mauro Boldi, “5G System Design – Architectural and Functional Considerations and Long Term Research”, Wiley, 2018

MINOR COURSES

Syllabus for Semester III,

B. Tech. (Electronics and Communication Engineering – MINOR)

Course Code: ECTM3100 Course: Fundamentals of Communication Engineering (MINOR Course)

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

After completion of this course, the students will be able to:

1. Analyze various analog modulation schemes such as AM, FM etc.
2. Understand basics of Noise includes effect of noise on communication
3. Analyze various digital modulation schemes
4. Analyze recent communication technologies such as CDMA, GSM etc.

Unit I
Basic Communication System, Classification of electronic communication system, Need of modulation, Principles of Amplitude Modulation Systems- DSB, SSB, Angle Modulation, Representation of FM and PM signals.

Unit II
Introduction to Noise, Types of Noise, Noise Calculation, Noise factor, Noise Temperature, Pre-Emphasis and De-Emphasis

Unit III
Pulse modulation, Pulse code modulation (PCM), Differential pulse code modulation, Delta modulation and Adaptive Delta Modulation

Unit IV
Digital Modulation schemes- Amplitude shift Keying, Phase Shift Keying, and Frequency Shift Keying.

Unit V
Spread – Spectrum Communication: - Study of PN sequences, direct sequence methods, Frequency hop methods, slow and fast frequency hop.
Code Division Multiple Access (CDMA), GSM, LTE, Recent Trends/Developments

Text Books:

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. B. P. Lathi, “Modern Digital and Analog Communication Systems”, Third Edition, Oxford University press.

Reference Books:

1. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
2. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.
3. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley, 1965.
4. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
5. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.
6. George Kenndey, 4th Edition , " Electronics Communication systems "

Syllabus for Semester IV,

B. Tech. (Electronics and Communication Engineering – MINOR)

Course Code: ECTM4100 **Course: Sensors for Smart City**
(MINOR Course)

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

After completion of this course, the students will be able to:

1. Employ the knowledge of mathematics, science, and engineering to understand fundamentals of sensor systems.
2. Understand the applications of sensors in smart cities.
3. Learn IEEE Standards for advance Sensors
4. Comprehend actuating devices for sensor systems.

UNIT I

Smart City: Concept, Definition, Criteria for smart cities, Smartness (Eg. Environment, Mobility, Economy, Utilities, Transportation, road Infrastructure, Health Care etc.)

Unit II

Sensor Characteristics: Transfer function, accuracy, calibration, hysteresis, nonlinearity, saturation, repeatability, dead band, resolution, output impedance, excitation, dynamic characteristics, environmental factors, reliability and application characteristics.

Unit III

Review of transducers for various parameters (like temperature, pressure, flow, level, humidity, acceleration, vibration etc.), Sensor Materials and overview of sensor technologies: Silicon as Sensing Material, Plastics, Metals, Ceramics, Glasses, Optical Glasses, Nano-materials, Overview of Surface Processing technologies.

Unit IV

IEEE Standards for advance Sensors: Fundamentals, IEEE 1451 standard for smart sensors, Sensor Signals and Systems, Sensor specifications, Sensor Characteristics, Physical principles of sensing.

Unit V

Applications: Smart street lighting, Smart Parking, Environmental pollution monitoring, Vehicular tracking, Smart Traffic Control, Waste Management, Smart Grid, Smart Cars, Smart Homes, Smart Domestic Appliances, Smart Toys etc.

TEXT BOOKS:

1. D.V.S.Murty, "Transducers and Instrumentation", Second edition, PHI publication, Second edition, 2010.
2. Randy Frank, "Understanding Smart Sensors", Artech House Inc., 2nd Edition.
3. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs, and Applications", Springer; 4th editon.
4. Carlo Ratti and Matthew Claudel, ―The City of Tomorrow: Sensors, Networks, Hackers, andthe Future of Urban Life (The Future Series), Yale University Press.

REFERENCE BOOKS:

1. Mohammad Hammoudeh & Mounir Arioua, "Sensors and Actuators in Smart Cities" (Open Access book) MDPI, Basel, Switzerland.
2. Gerard Meijer, "Smart sensor systems", Wiley, 2008
3. W Gopel, J. Hesse, J. N. Zemel, "Sensors A Comprehensive Survey" Vol. 9, Wiley-VCH, 1995

Syllabus for Semester V,

B. Tech. (Electronics and Communication Engineering – MINOR)

Course Code: ECTM5100 **Course: IoT for Industrial Application (MINOR Course)**

L: 4 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 04**

Course Objectives

The objective of this course is to make students aware of:

1. IoT scope and its applications
2. Hands on experience with Raspberry pi SBC
3. Python Programming and Linux environment

Course outcomes

After completion of this course students will be able to:

1. Understand the scope of IoT.
2. Explore the linux environment for SBC (Single Board Computer)
3. Demonstrate IoT based applications on Raspberry Pi
4. Use Python-based IDE and trace and debug Python code on the Raspberry Pi for IoT applications.

Unit I

Introduction to Internet of Things: Concept and its need, architecture, scope and applications, Overview of Networking and protocols applicable to IoT.

Unit II

Exploring the platforms/ hardware for IoT: Getting Started with Raspberry Pi, Basic and functionality of the Raspberry Pi board and its Processor, setting and configuring the board, differentiating Raspberry Pi from other platform like Arduino, Over-clocking, Component overview.

Unit III

Introduction to Linux: Implications of an operating system on the behaviour of the Raspberry Pi, Overview of Linux and its terminal command, apt-get-update, apt-get-upgrade, navigating the file system and managing processes, text-based user interface through the shell, overview of graphic user interface.

Unit IV

Programming the Raspberry Pi: Python: Introduction to Python programming language : Python Programming Environment, Python Expressions, Strings, Functions, Function Arguments, Lists, List Methods, Control Flow, Numpy, PIP (Python Installation Package) and customized libraries.

Unit V

Sensors and Actuators (Light Sensors, Ultrasonic, Temperature and humidity,etc) for IoT, Wired and Wireless communication, Communication facilities on raspberry Pi (I2C, SPI, UART), working with RPi. GPIO library, Communication Using Raspberry Pi for IoT applications.

Unit VI

Applications of IoT: case studies based on Commercial products, Applications / Product Development of IoT based application

Text Books:

1) Designing the Internet of Things, Adrian McEween and Hakim Cassimally, 1st Edition John Wiley and Sons, Ltd.

Reference Books:

1. Learning of Internet of Things, Peter Waher, 1st Edition Packet Publishing.
2. Raspberry Pi 3 : An Introduction to Using with PythonScratch, Javascript and more, Gary Mitnick, CreateSpace Independent Publishing Platform, 2017.
3. Raspberry Pi for Python Programmers Cookbook, Tim Cox, Packt Publishing Limited; 2nd Revised edition, 2016.
4. Raspberry Pi User Guide, Eben Upton and Gareth Halfacreee, John Wiley & Sons, 2016

Syllabus for Semester VI,

B. Tech. (Electronics and Communication Engineering – MINOR)

Course Code: ECTM6100 **Course: Future Generation Networks (MINOR Course)**

L: 4 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 04**

Course Objectives

The objective of this course is to make students aware of:

1. Fundamentals of wireless communications
2. Existing and emerging wireless communications networks
3. Evolution of wireless networks from the first generation to LTE and LTE advanced, 5G

Course outcomes

After completion of this course students will be able to:

1. Understand diversity techniques to improve performance
2. Describe current and future cellular mobile communication systems
3. Learn 3G and 4G Major Technical Standards
4. Describe the characteristics of the OFDM, 5G system concepts

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UNIT I

Overview of wireless communications and systems, Review of digital communications, Cellular systems from 1G to 3G

UNIT II

Wide-area wireless networks (WANs),3G and 4G Wireless Standards- GSM, GPRS, WCDMA

UNIT III

Long Term Evolution Technologies (LTE), OFDM, MIMO channels, LTE Advanced

UNIT IV

OFDM -Introduction, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues

UNIT V

MIMO -Introduction, MIMO Channel Capacity, Other Wireless systems IEEE 802.11, WLAN (Wi-Fi) WiMAX

UNIT VI

5G – Introduction, Architecture, Basics about RAN Architecture, Physical Architecture and 5G Deployment

Text Books:

1. Wireless Communication, Rappaport, 2nd Edition Pearson
2. Mobile Wireless Communications, Mischa Schwartz. Paperback (2013) ISBN: 978110741271
3. Cambridge University Press. References: The evolution to 4G cellular systems: LTE-Advanced. Ian F. Akyildiz, David M. Gutierrez Estevez, Elias Chavarria Reyes.

Reference Books:

1. Iti Saha Misra, "Wireless Communication and Networks – 3G and Beyond", Mc Graw Hill Education, Second Edition, 2013.
2. Jochen Schiller, "Mobile Communications", Pearson Education, Second Edition, 2012.

SEMESTER – VII

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7001 **Course: Computer Networks**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand computer networks and reference models.
2. Identify components of computer networks, multiple access, switching and routing techniques.
3. Comprehend the concepts of network security, layer services and protocols
4. Analyze error, flow and congestion control techniques, associated protocols and LAN standards
5. Design a network using addressing mechanisms.

Unit I

Introduction to computer networks and the Internet, Network types: LAN, MAN, WAN, Layered architecture, Reference models- OSI and TCP/IP, design issues for layers, protocols and standards, Transmission media.

Unit II

Multiple Access Resolution, Data Link Control- Framing, Error Control and Flow Control: Sliding Window Protocols, LAN standards, IEEE 802.

Unit III

Circuit Switching, Message Switching and Packet Switching, Virtual circuit and Datagram networks, WAN technologies - ATM and SONET, Network Layer: IP Addressing: IPv4, IPv6, Routing Algorithm.

Unit IV

Transport layer protocols, Congestion control and Quality of Service in transport layer.

Application Layer: The Web and Hyper Text Transfer Protocol, File transfer, Domain name system, E-mail.

Unit V

Introduction to Cryptography, Symmetric-Key Cryptography and Asymmetric-Key Cryptography, Security Services, key distribution and certification, digital signature, management of public keys.

Text Books:

1. Forouzan, " Data Communications and Networking" , Tata McGraw Hill, 4th Edition
2. J.F. Kurose and K. W. Ross, " Computer Networking – A top down approach featuring the Internet" , Pearson Education, 5th Edition

Reference Books:

1. Andrew Tanenbaum, " Computer networks" , Prentice Hall
2. William Stallings, " Data and computer communications" , Prentice Hall
3. T. Viswanathan, " Telecommunication Switching System and Networks" , Prentice Hall
4. L. Peterson and B. Davie, " Computer Networks – A Systems Approach" Elsevier
   Morgan Kaufmann Publisher, 5th Edition.
5. S. Keshav, " An Engineering Approach to Computer Networking" , Pearson Education

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP7001 **Course: Computer Networks Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Use simulation tools to configure and analyze network performance.
2. Configure host, server, switches and routers for networking.
3. Configure the network for sharing of resources.
4. Analyze protocols for the computer networking.
5. Design and configure a network using addressing mechanisms and protocols.

Experiments based on following topics:

- Simulate & configure different types of networks using network stimulation tools.
- Configure different devices like routers, host machines for setting up a network
- networking concepts like client-Server and addressing mechanism
- Static and Dynamic Routing

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7002 – 1 **Course: Microwave Theory and Techniques (Program Elective – 3)**

L: 3Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand the basic concepts of microwave engineering and applications.
2. Compare the types of transmission lines and modes of propagation.
3. Explain Design Principles of microwave components and antennas.
4. Analyze the functions of active and passive microwave components.
5. Evaluate microwave parameters by measurement techniques.

Unit –I:

Introduction to Microwaves- History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI/EMC.

Analysis of RF and Microwave Transmission Lines – Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Microstrip line.

Microwave Network Analysis- Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters.

Unit –II:

Passive and Active Microwave Devices-Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, PIN diodes, Microwave Tubes: Klystron, TWT, Magnetron.

Unit – III:

Microwave Design Principles-Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas-Antenna parameters, Planar Antennas, Antenna for ground based systems, Antennas for air borne and satellite borne systems.

Unit –IV:

Microwave Measurements- Power, Frequency, VSWR and Impedance measurement at microwave frequency, Network Analyzer, Spectrum Analyzer and measurement of spectrum of a microwave signal. Measurement of Microwave antenna parameters.

Unit – V:

Applications of Microwave Engineering – Radar block diagram, Radar range equation, CW & FM Modulated radar, MTI & Pulse Doppler Radar, Tracking Radar, Radar Receivers, Radar antenna.

Text Books:

1. Microwave Circuits, R. E. Collins, McGraw Hill.
2. Microwave Circuits, K. C. Gupta and I. J. Bahl, Artech house.

Reference Books:

1. Microwave device and circuits: Samuel Y. Lio, 3 Edition, PHI.
2. Introduction of radar systems: Skolilik, McGraw hill.
3. Microwave theory and measurement: G. Lance.

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7002 – 2 **Course: 5G and Next Generation Communication Systems (Program Elective – 3)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course, students will demonstrate the ability to

1. Understand the evolution from 1G to 5G and key features of 5G
2. Interpret 5G architecture and New Radio (NR) concepts to describe functional, physical, and protocol-level operations in real-world deployment scenarios
3. Analyse MTC and D2D communication techniques in 5G
4. Evaluate spectrum management and bandwidth optimization in 5G
5. Conceptualize future communication solutions beyond 5G

Unit I

Foundations of 5G Networks: Evolution from 1G to 5G and key technological milestones, Benefits and limitations of 5G compared to earlier generations, Global standards and organizations shaping 5G development, 5G Use cases

Unit II

5G Architecture: Basics about RAN architecture, 5G New Radio Access Technology; 5G NR Global view; NR- PhysicalLayer: Radio Protocol Architecture, Functional architecture, 5G flexibility, Physical architecture and 5G deployment

Unit III

Machine Type Communication and Device-to-Device Communication: Use cases and categorization of MTC, MTC requirements; Fundamental techniques for MTC: Data andcontrol for short packets, non-orthogonal access protocols; Massive MTC, D2D: from 4G to 5G, Radio resource management for mobile broadband D2D

Unit IV

Spectrum and Bandwidth Management: Spectrum challenges in 5G, Spectrum allocation strategies for 5G deployment, High, mid and low band frequencies and their use cases, Bandwidth optimization techniques for high-performance networks, Regulatory and policy frameworks for spectrum management

Unit V

Beyond 5G – Emerging Technologies: Early research and vision for 6G communication systems, Integration of Satellite and non-terrestrial networks, Potential of quantum communication in future networks, Trends shaping evolution of global communication.

TEXT BOOKS:

1. Afif Osseiran, Jose F Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016
2. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies", CRC Press, Taylor & Francis Group, First Edition, 2018
3. Harri Holma, Antti Toskala, Takehiro Nakamura, "5G Technology 3GPP NEW RADIO", John Wiley & Sons, First Edition,2020

REFERENCE BOOKS:

1. Ali Zaidi, Fredrik Athley, Jonas Medbo, Ulf Gustavsson, Giuseppe Durisi, Xiaoming Chen, "5G Physical Layer, Principles, Models and Technology, Components, Academic Press, 2018.
2. Saad Z. Asif, "5G Mobile Communications: Concepts and Technologies", CRC Press, 2019.

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7002 – 3 Course: VLSI Fabrication: Tools and Techniques (Program Elective – 3)

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 03

Course Outcomes

At the end of this course students will be able to

1. Recall the concepts of silicon crystal growth, wafer preparation, and cleaning methods.
2. Explain oxidation, epitaxy, and thin film growth techniques in semiconductor fabrication.
3. Apply photolithography, etching, and pattern transfer methods to microfabrication processes.
4. Analyze diffusion and ion implantation processes for effective doping control in semiconductors.
5. Evaluate metallization, packaging, testing, and the overall CMOS fabrication sequence.

Unit – I:

VLSI Process Integration: Introduction , Fundamental Considerations for IC Processing, NMOS IC Technology, CMOS IC Technology, MOS Memory IC Technology, IC Fabrication.

Unit – II:

Crystal Growth and Wafer Preparation: Introduction , Electronic grade Silicon, Czochralski Crystal Growing , Silicon Shaping , Processing Considerations

Unit – III:

Epitacy: Introduction , Vapor Phase Epitaxy , Molecular Beam Epitaxy, Silicon on Insulators, Epitaxial Evaluation .

Oxidation: Introduction , Growth Mechanism and Kinematics , Thin Oxides ,Oxidation Techniques and Systems .Oxidation of Polysilicon

Unit – IV:

Lithography: Introduction, Optical Lithography, Electron Lithography, Ion Lithography, Plasma properties, Feature size control and Anisotropic Etch Mechanism, Reactive Plasma Etching Techniques and Equipment, Specific Etch Process

Unit – V:

Dielectric and Polysilicon Film Deposition: Introduction, Deposition Process ,Polysilicon, Silicon Dioxide , Automatic Diffusion Mechanism, Measurement Techniques, Range Theory, Metalization, Metalization Applications, Metalization Choices, Patterning, Metalization Problems.

TEXT BOOKS

1. S.M.Sze"VLSI Technology", McGraw Hill Companies Inc. (2nd Edition)"
2. C.Y. Chang and S.M.Sze (Ed), "ULSI Technology", McGraw Hill Companies Inc.

REFERENCE BOOKS

1. Stephena, Campbell, "The Science and Engineering of Microelectronic Fabrication", Second Edition, Oxford University Press.
2. James D.Plummer, Michael D.Deal, "Silicon VLSI Technology" Pearson Education
3. VLSI Technology by Wai-Kai Chen Editor in Chief CRC press

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7003 – 1 **Course: Smart Antennas (Program Elective – 4)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Understand basic concepts of smart and adaptive antennas.
2. Apply different adaptive algorithms for 5G antenna.
3. Analyze the concept of direction of arrival and angle of arrival.
4. Design of antenna array architectures to meet 5G requirement
5. Apply the concepts of MIMO systems for Smart Antennas

Unit I

5G Concepts: 5G Objectives and Usage Scenarios, 5G Activities, Channel Access Method/Air Interface, 5G Policy, 5G Timelines, 4G/5G Radio Access Network, 5G system concept, LTE-Advanced, LTE-Advanced Pro, 5G NR, The 5G architecture, Spectrum Analysis and Regulations for 5G

Unit II

Introduction to smart antenna: Introduction to Smart Antennas, Architecture of a Smart Antenna System: Transmitter and Receiver, Types of Smart Antennas, Benefits and Drawbacks of Smart Antennas, Applications of Smart Antennas.

Unit III

Smart Antenna Configurations: Fixed Sidelobe Canceling, Retrodirective Arrays, Beamforming, Adaptive Arrays, Butler Matrix, Spatial Filtering with Beamformers, Switched Beam Systems, Multiple Fixed Beam System. Uplink Processing, Diversity Techniques, Angle Diversity, Maximum Ratio Combining, Adaptive Beamforming, Fixed Multiple Beams versus Adaptive Beamforming, Downlink Processing.

Unit IV

Angle-of-Arrival Estimation: Fundamentals of Matrix Algebra, Array Correlation Matrix, AOA Estimation Methods: Bartlett AOA Estimate, Capon AOA Estimate, Linear Prediction AOA Estimate, Maximum Entropy AOA Estimate, Pisarenko Harmonic Decomposition AOA Estimate, Min-Norm AOA Estimate, MUSIC AOA Estimate, ESPRIT AOA Estimate.

Unit V

MIMO Antennas: Introduction, Multiple-Antenna MS Design, RAKE Receiver Size, Mutual Coupling Effects, Dual-Antenna Performance Improvements, Downlink Capacity Gains, Principles of MIMO systems: SISO, SIMO, MISO,MIMO, Hybrid antenna array for mmWave massive MIMO: Massive Hybrid Array Architectures, Hardware Design for Analog Subarray.

Text Books:

1. Ahmed El Zooghby, 'Smart Antenna Engineering', ARTECH HOUSE, INC, 2005.
2. Frank B. Gross, 'Smart antenna with MATLAB', 2nd Edition, McGraw-Hill, 2015.

Reference Books:

1. Lal Chand Godara , "SMART ANTENNAS" , CRC PR ESS, 2004
2. Shahid Mumtaz, Jonathan Rodriguez, Linglong Dai mmWave Massive MIMO: A Paradigm for 5G
3. C. A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 3rd edition.

Syllabus for Semester VII, B0. Tech. (Electronics and Communication Engineering)

Course Code: ECT7003 – 2	**Course: Artificial Intelligence (Program Elective – 4)**
L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week	**Total Credits: 03**

Course outcomes: -

At the end of this course students will demonstrate the ability to

1. Understand uncertainty theory in designing AI systems.
2. Solve AI problems through programming languages.
3. Apply optimization and inference algorithms for modelling.
4. Create agents to learn and act in a structured environment.
5. Build intelligent agents for search and games.

Unit –I:

Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.

Unit – II:

Search Algorithms: Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.

Unit –III:

Probabilistic Reasoning: Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.

Unit – IV:

Markov Decision Process: MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs

Unit –V:

Reinforcement Learning: Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning, Machine Learning Fundamentals**,** Neural Network Fundamentals, Deep Learning Fundamentals**,** Computer Vision Fundamentals, Future of AI.

Text Books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , 3rd Edition, Prentice Hall
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill

Reference Books:

1. Trivedi, M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, Delhi.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011
3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7003 – 3 **Course: Fundamentals of Physical Design (Program Elective – 4)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Describe the VLSI design flow and styles
2. Use algorithmic graph theory and combinatorial optimization techniques to formulate and solve VLSI design problems
3. Explain the algorithms for partitioning, floor planning, placement and routing
4. Describe the process of Static Timing Analysis of VLSI circuits.
5. Implement low power physical design.

Unit – I:

Introduction to VLSI CAD : VLSI design methodologies, use of VLSI CAD tools, Algorithmic Graph Theory and computational Complexity.

High-level Synthesis : Hardware Models for High-level Synthesis, Internal Representation of the Input Algorithm, and Understanding RTL to Gate Level design mapping. Basic concept of Static Timing Analysis (STA).

Unit – II:

Partitioning : Introduction, Types of Partitioning, Classification of partitioning Algorithm, KL algorithm.

Floor-planning : Introduction, Sliced and non-sliced planning, Polish expression, Power planning, IO Planning

Unit – III:

Placement : Introduction, classification of placement algorithms, partition based placement, timing /congestion aware Placement

Unit – IV:

Clock Tree Synthesis: Different topologies of Clock Tree Structure. Overview on Clock Mesh implementation for High Performance designs. Routing: Fundamental Concepts of Steiner trees, Two phases of Routing: Global routing & detailed routing, Routing Algorithms

Unit – V:

Low Power Physical Design: Understanding Various Power Optimization algorithms (dynamic and Leakage), Overview on implementation and complexities involved in low power PD.

SOC Physical Design: Re-convergent model of VLSI SOC Design, SOC Physical design, advanced physical design of SOCs.

Text books

1. VLSI Physical Design Automation: Theory and Practice: Sadiq M. Sait, Habib Youssef, McGraw-Hill 2004.
2. VLSI Physical Design: From Graph Partitioning to Timing Closure: Jin Hu, Jens Lienig, Igor L. Markov, Andrew B. Kahng, Springer, Dordrecht 2011.
3. Handbook of Algorithms for Physical Design Automation: Charles J Alpert, Dinesh P Mehta, Sachin S Sapatnekar, CRC Press, 2008.
4. A Practical Approach to VLSI System on Chip (SoC) Design, Veena Chakravarthi, Springer International Publishing 2020

Reference books

1. Physical Design Essentials: An ASIC Design Implementation Perspective: Khosrow Golshan, Springer, (2007)
2. Static Timing Analysis for Nanometer Designs: A Practical Approach: J. Bhasker and Rakesh Chadha, Springer, (2009).
3. Practical Problems in VLSI Physical Design Automation, Sung Kyu Lim, Springer, (2008), ISBN 978-1402066269
4. Algorithms for VLSI Design Automation: Sabih H. Gerez and John Wiley,(1998).
5. An Introduction to VLSI Physical Design: Majid Sarrafzadeh and C. K. Wong, McGraw Hill, (1996).
6. Algorithms for VLSI Physical Design Automation: Naveed Sherwani, Kluwer Academic Pub., (1999).

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7004 – 1 **Course: Wireless Sensor Networks (Program Elective – 5)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand sensor networks and types of Wireless Sensor Networks (WSN)
2. Comprehend Routing and MAC protocols for different communication standards used in WSN
3. Explore new protocols for WSN.
4. Analyze the performance of Mobile Ad-hoc Networks (MANETs) and WSN.
5. Conduct case study of wireless sensor networks for a given application.

Unit –I:

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks.

Unit – II:

Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks, Issues and challenges in wireless sensor networks.

Unit –III:

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee,

Unit – IV:

Dissemination protocol for large sensor network, Data dissemination, data gathering and data fusion, Quality of a sensor network, Real-time traffic support and security protocols.

Unit –V:

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication, Single-node architecture, Hardware

components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Text Books:

1. Waltenegus Dargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks Theory and Practice”, By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009

Reference Books:

1. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004
2. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science
3. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7004 – 2 **Course: Digital Image Processing (Program Elective – 5)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand fundamentals of acquisition, representations and pixel operations of digital Image.
2. Apply image transforms for analysis and compression.
3. Perform image processing operations for enhancement and inspection.
4. Perform segmentation, filtering and de-noising on image.
5. Develop Image processing applications.

Unit –I:

Fundamentals of Image processing: Introduction & Applications, Elements of visual perception, Image sensing and acquisition, simple image formation, Image sampling and Quantization, Representing digital pixels, Basic relationship between pixels, Image quality, Introduction to colour image – RGB and HSI Models.

Unit – II:

Image Transforms: General 2 –D Image transform relation, Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Sine Transform (DST), Discrete Wavelet transforms.

Unit – III:

Image Processing Techniques: Image Enhancement, Spatial Domain methods- Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency Domain methods- Basics of filtering in frequency domain, image smoothing, imagesharpening, selective filtering.

Unit –IV:

Image Segmentation- Segmentation concepts, point, line and Edge detection, Thresholding methods, Region based segmentation.Representation and description –Representation, boundary descriptors,Regional descriptors,Edge linking and boundary detection,

Unit – V:

Image Compression: Image compression fundamentals –coding Redundancy, spatial and temporal redundancy. Compression models- Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards

Text Books:

1) Digital image processing: *Rafel C. Gonzalez and Richard E. Woods, Addition-wisely*
2) Fundamental of digital image processing: *Anil K. Jain, PHI*

Reference Books:

1) Image Processing, Analysis and Machine Vision: *Milan Sonka, Vaclav Hlavac and Roger Boyle.*
2) Digital picture processing: *Rosenfeld A.C. Kak, academic press inc 1976.*
3) Computer image processing and recognition: *Hall E.L., academic press inc 1979.*
4) Picture processing and digital filtering: *Huang T.S., Springer Verlag, Berlin Heidelberg.*

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7004 – 3 **Course: VLSI Signal Processing (Program Elective – 4)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Explain the basic understanding of discrete signals and systems
2. Apply the pipelining and parallel processing techniques
3. Re-Design the DSP systems for the given constraints using retiming techniques
4. Fold and unfold the DSP systems.
5. Analyze data flow in systolic architectures

Unit I

Introduction to Digital Signal Processing (DSP) systems, sampling theorem, discrete time signal & systems, representation of discrete systems in Z domain, basic DSP algorithms and its mathematical representation, representation of DSP algorithms using block diagram, data flow graph, dependence graph, signal flow graph, Loop bound and Iteration bound algorithms, difference between recursive(IIR) and non-recursive (FIR) systems

Unit II

Basics of pipelining and parallel processing, cut-set theory, data broadcast structure and transpose structure of FIR systems, fine-grain and course-grain pipelining techniques, realizing a parallel architecture for FIR systems, pipelining and parallel processing for low power.

Unit III

Retiming algorithm for IIR systems, cut set retiming and pipelining, retiming for clock period minimization, retiming for register minimization.

Unit IV

Unfolding algorithms, properties, unfolding for sample period reduction, word level processing, bit level processing, register minimization techniques using folding transformation

Unit V

Folding algorithms, properties, register minimization techniques using folding transformation, systolic architecture design, block diagram, space representation, edge mapping table, low level implementations, space time representation for systolic arrays.

Text Books:

1. VLSI Digital Signal Processing Systems, Keshab K. Parhi, A Wiley-Interscience Publication, 1999

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7005 **Course: Control Systems**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Understand feedback control systems.
2. Determine transfer function of a system.
3. Apply mathematical and graphical tool(s) to perform the stability analysis of the system.
4. Analyze systems in the time and frequency domain and discuss techniques for improving the system response.
5. Develop State Model for the given System/Transfer Function.

Unit I

Introduction to need for automation and automatic control, use of feedback, Board spectrum of system application, Transfer Functions, block diagram, signal flow graphs, analysis of parameter variation, Control system components.

Unit II

Time response of system, Types and order of system, Standard input, concept of gain and time constants, Steady State error, Time response specifications, approximate methods for higher order system, Introduction to controllers.

Unit III

Stability of control systems, conditions of stability, characteristic equation, Routh's – Hurwitz criterion, special cases for determining relative stability. Root location and its effect on time response, Elementary idea of Root Locus, effect of adding pole and zero and proximity of imaginary axis.

Unit IV

Frequency response method of analyzing linear system, Nyquist and Bode plot, Nyquist criterion, Stability and accuracy analysis from frequency response, frequency response analysis of Operational Amplifier.

Unit V

State variable method of analysis: characteristic of system state, choice of state representation of vector matrix different equation, standard form, relation between transfer function and state variable.

Text Books:

1. Control systems Engineering: I. J. Nagrath and M. Gopal, 5th Edition, New Age International Limited, Publishers (Formerly Wiley Eastern Limited)
2. Modern Control Engineering: Katsihiko Ogata -3e - Prentice -Hall of India

Reference Books:

3. Introduction to Feedback Control: Li Qui and Kemin Zhou, Pearson Education.
4. Control Systems – Principles and Design: M. Gopal, 3rd Edition, Tata McGraw Hill Education Private Limited, New Delhi.

Syllabus for Semester VII, B. E. (Electronics and Communication Engineering)

Course Code: ECT7006 Course: System Software and Operating Systems

L: 2 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 02

Course Outcomes:

On successful completion of the course, students will be able to demonstrate:

1. Ability to describe the general architecture of computers, Contrast and compare differing structures for operating systems.
2. Ability to understand and analyze theory and implementation of processes and schedulers.
3. Ability to understand and design resource control (synchronization and deadlock).
4. Ability to apply knowledge of physical and virtual memory, scheduling, I/O and files.

Unit I:

Introduction: Evolution of OS, Types of OS, Basic h/w support necessary for modern operating systems, services provided by OS, system programs and system calls, system design and implementation.

Unit II:

Process Management: Process concept, Process control block, Types of scheduler, Context switch, Multithreading model, Goals of scheduling and different scheduling algorithms.

Process cooperation and synchronization: Concurrency conditions**,** Critical section problem, software and hardware solution, Semaphores, conditional critical regions and monitors, Classical Inter process Communication Problems.

Unit III:

Deadlocks: System Model, Deadlock characterization, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and recovery

Memory management: Basics of Memory Management, Swapping, Memory allocation, Paging, Demand Paging, Segmentation, Virtual memory, Page replacement, Page replacement algorithms

Unit IV:

File systems: File concept, Access methods, Disk space management and space allocation strategies, Directory structures, Recovery, Log-structured File System, Disk arm scheduling strategies

Text Books:

1. *Operating System concepts*: Silberchatz and Galvin, 6th Edition, John Wiley and Sons, 2001.
2. *Modern Operating Systems*: Tanenbaum, 2nd Edition, PHI, 2001.

Reference Books:

1. *Operating System*: Milan Milenkovik, 2nd Edition, Tata McGraw Hill 1997.

Syllabus for Semester VII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP7007 **Course: Major Project Phase 2**

L: 0 Hrs, T: 0 Hr, P: 4 Hrs. Per week **Total Credits: 02**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Implement project modules and circuit blocks initial/intermediate versions.
2. Test and validate individual project modules.
3. Integrate hardware and/or software modules for identified problems.
4. Lab-test and validate the modules of implemented project system.
5. Field-test the implemented system and summarize through presentation skills, publication and report writing.

The students will carry out following tasks for Major Project Phase 2

1. In depth study of the topic assigned in the light of the Report prepared under Project Stage- I
2. Review and finalization of the Approach to the Problem relating to the assigned topic
3. Preparing an Action Plan for conducting the investigation, including team work
4. Detailed Analysis//Simulation/Design/Problem Solving/Experiment as needed
5. Final development of product/process, testing, results, conclusions and future directions
6. Preparing a paper for Conference presentation/Publication in Journals, if possible
7. Preparing a Dissertation in the standard format for being evaluated by the Department
8. Final Seminar Presentation before a Departmental Committee

SEMESTER – VIII

Syllabus for Semester VIII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT8001 – 1 Course: Network Planning and Management Policies (Program Elective – 6)

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week Total Credits: 03

Course Outcomes:
At the end of this course students will be able to:

1. Understand user needs, application requirements, and constraints for Network planning
2. Explore manager-agent relationships and network management station (NMS) platforms.
3. Implement remote monitoring for Ethernet and Token Ring groups to monitor traffic at remote sites
4. Track user usage & resource allocation and Implement firewalls& encryption policies
5. Define rules for traffic prioritization (QoS) and network access control

UNIT I: Introduction to Network Planning
Network Management Goals: Understanding service level agreements (SLAs), network provisioning, and operations.
Design Methodology: Comparing top-down versus bottom-up design approaches and analyzing business and technical goals.
Requirements Analysis: Identifying user needs, application requirements, and constraints such as scalability, availability, and affordability.

UNIT II: Network Management Architecture & Models
Management Frameworks: Studying standards like **the** OSI Management Model **and** Internet Management Model (SNMP)**.**
Organization Models: Understanding manager-agent relationships and network management station (NMS) platforms.
Information Models: Exploring Management Information Bases (MIBs) and Management Information Trees.

UNIT III: Management Protocols & Monitoring
SNMP (Simple Network Management Protocol): Versions v1, v2, and v3, including structure of management information (SMI) and operations.
RMON (Remote Monitoring): Implementing RMON1 and RMON2 for Ethernet and Token Ring groups to monitor traffic at remote sites.

UNIT IV: Network Management Functions (FCAPS)

Fault Management: Detection, isolation, and correction of network errors.
Configuration Management: Maintaining inventory and managing device settings and updates.
Accounting Management: Tracking user usage and resource allocation
Performance Management: Monitoring throughput, response time, and capacity planning.
Security Management: Implementing firewalls, ACLs, and encryption policies.

UNIT V : Policy-Based Management & Trends
Policy Management: Defining rules for traffic prioritization (QoS) and network access control.
Emerging Technologies: Overview of Software Defined Networking (SDN), Cloud management, and broadband management (DSL/Cable Modem)

Text Books:

1. Network Management: Principles and Practice, 2nd Edition, by Mani Subramanian
2. Principles of Computer Systems and Network Management by Dinesh Chandra Verma

Reference Books:

1. Network Management Fundamentals by Alexander Clemm
2. Policy-Based Network Management by John Strassner

Syllabus for Semester VIII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT7001 – 2	**Course: Deep Learning (Program Elective – 6)**
L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week	**Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Apply fully connected deep neural networks to real-world problem-solving scenarios.
2. Evaluate the performance of various deep learning models in terms of optimization, bias-variance trade-off, overfitting, and underfitting.
3. Analyze the role of convolutional and recurrent neural networks in addressing different real-world problems.
4. Create advanced deep learning models by designing variants of CNNs and RNNs tailored to specific applications

UNIT I:

Basics of Deep Learning: History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons,, Perceptron Learning Algorithm and Convergence, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons.

UNIT II:

Training of Feedforward Neural Networks: Feedforward Neural Networks, Representation Power of Feedforward Neural Networks, Training of Feedforward Neural Networks, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam

UNIT III:

Optimization Algorithm: Activation Function and Initialization Methods: Sigmoid, Tanh, ReLU, Xavier and He Initialization, Regularization: Bias and Variance, Overfitting, Hyperparameters Tuning, L1 and L2 Regularization, Data Augmentation and Early Stopping, Parameter Sharing and Tying.

UNIT IV:

Convolutional Neural Network (CNN): Convolutional Neural Networks, 1D and 2D Convolution, Visualizing Convolutional Neural Networks, Guided Backpropagation.

UNIT V:

Recurrent Neural Network (RNN): Recurrent Neural Networks, Backpropagation Through Time (BPTT), Vanishing and Exploding Gradients, Long Short-Term Memory (LSTM) Cells, Gated Recurrent Units (GRUs), Variants of CNN and RNN Encoder-Decoder Models, Attention Mechanism, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet.

Text Books:

1. Sandro Skansi, Introduction to Deep Learning, Springer
2. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer, 2019
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016
4. Dr. S. Lovelyn Rose, Dr. L. Ashok Kumar, Dr. D. Karthika Renuka, Deep Learning using Python, Wiley Publication

Reference Books:

1. Bishop, C. M., Pattern Recognition and Machine Learning, Springer, 2006
2. Yegnanarayana, B., Artificial Neural Networks, PHI Learning Pvt. Ltd., 2009
3. A. Ravindran, K. M. Ragsdell, and G. V. Reklaitis, Engineering Optimization: Methods and Applications, John Wiley & Sons, Inc., 2016

Syllabus for Semester VIII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT8001 – 3 **Course: VLSI Testing and Verification (Program Elective – 6)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes: -

At the end of this course students will demonstrate the ability to

1. Identify the problems associated with testing of semiconductor circuits at earlier design levels
2. Analyze the various test generation methods for static & dynamic CMOS circuits.
3. Interpret the Memory Test Architectures and Techniques.
4. Propose the design for testability methods for combinational & sequential CMOS circuits.
5. Establish the BIST techniques for improving testability.

Unit – I:

Basics of Testing And Fault Modeling: Introduction to Testing - Faults in digital circuits - Modeling of faults - Logical Fault Models - Fault detection - Fault location - Fault dominance - Logic Simulation - Types of simulation - Delay models - Gate level Event-driven simulation.

Unit – II:

Test Generation for Combinational and Sequential Circuits: Test generation for combinational logic circuits - Testable combinational logic circuit design - Test generation for sequential circuits - design of testable sequential circuits.

Unit – III:

Design For Testability: Design for Testability - Ad-hoc design - Generic scan based design - Classical scan based design – System level DFT approaches.

Unit – IV:

Self Test and Test Algorithms: Built-In Self Test - Test pattern generation for BIST - Circular BIST - BIST Architectures - Testable Memory Design – Test algorithms - Test generation for Embedded RAMs.

Unit – V:

Fault Diagnosis Logic: Level Diagnosis - Diagnosis by UUT reduction - Fault Diagnosis for Combinational Circuits - Self-checking design - System Level Diagnosis.

TEXT BOOKS

1. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design", Jaico Publishing House.
2. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers.

REFERENCE BOOKS

1. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.
2. A.L. Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice Hall International.

Syllabus for Semester VIII, B.Tech. (Electronics and Communication Engineering)

Course Code: ECT8002 – 1 **Course: Optical and Satellite Communication (Program Elective – 7)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

On completion of this course students will be able to understand:

1. Recent advancements in fiber optics, its working principle and its applications.
2. Splicing techniques, couplers, connectors and losses in OFC systems.
3. The principle of operation of optical sources and detectors and its parameter consideration while designing particular system.
4. Satellites subsystems & launching.
5. Link designing problems and finding engineering solution.

Unit – I

Principle of optical fiber communication, Advantages and applications, Ray model, Total internal reflection phenomenon, Acceptance angle, acceptance cone, Numerical aperture, Structures and characteristics of various fibers such as step index, graded index, Single mode and multi mode fibers, Meridional and skew rays.

Unit – II

Fiber joints, splices and connectors and couplers. Signal degradation in fibers – Attenuation, dispersion, bending losses, scattering losses, Absorption losses, propagation losses.

Unit – III

Optical sources – LED and LASER, Structures and properties, Source launching and coupling.

Photo detector – PIN and Avalanche Photo-detectors, Structures and Properties, Optical receiver.

Unit- IV

Introduction, Origin of satellite communication, Current state of satellite communication, General features, Satellite Frequency bands allocation

Introduction to Keplers laws, Orbital dynamics, Orbital characteristics, Satellite spacing and orbital capacity, Angle of Elevation eclipses, Launching and positioning

Unit V

Satellite construction (Space segment), Attitude and orbit control system, Telemetry, Tracking and command, Power systems, Communication sub-systems, Antenna sub-systems, Satellite transponder, Earth station subsystems, different types of earth stations.

Satellite links: Introduction to general link design equation, System noise temperature, Satellite uplink & downlink design and analysis.

Text Books:

1) Optical fiber communication, principles and practice: *John M. Senior, PHI*
2) Optical fiber communication: *B. Keiser, Tata Mc-Graw Hill*
3) Satellite Communication: *T. Pratt*
4) Satellite Communication: *Dennis Roddy*

Reference Books

1) Optical communication system: *J. Gower, PHI.*
2) Optical Fiber System : *Kao, Tata Mc Graw Hill*
3) Satellite communication Systems – Design Principles: *M. Richaria,*
4) Satellite communication Systems engineering: *Wilbur L. Pritchars, Henri G Suyder and Robert A. Nelson, Pearson Education Ltd*

Syllabus for Semester VIII, B.Tech. (Electronics and Communication Engineering)

Course Code: ECT8002 – 2 **Course: Networks and Systems Security (Program Elective – 7)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

At the end of this course, students will be able to:

1. Explain security goals, threat models, and fundamental cryptographic concepts used in modern information security.
2. Analyze network security mechanisms and protocols for secure communication.
3. Examine system-level vulnerabilities, attacks, and corresponding defense techniques.
4. Evaluate security challenges in emerging technologies such as IoT, cloud, and cyber-physical systems.
5. Apply security concepts to real-world domains including critical infrastructure, mobile, and wireless systems.

Unit – I:

Advanced Cryptographic Concepts and Security Foundations: Security goals and threat models, review of symmetric and asymmetric cryptography, hashing and digital signatures, advanced cryptographic concepts, limitations of classical approaches, introduction to modern cryptographic applications.

Unit – II:

Network Security: Key distribution, access control, transport layer security (HTTPS, SSH), wireless network security, electronic mail security, Internet Protocol Security (IPSec), virtual private networks (VPN), firewalls, and network intrusion detection systems.

Unit – III:

System Security: Malware, program analysis, penetration testing, common injection attacks (command injection, SQL injection, cross-site scripting), defense mechanisms, embedded system and hardware security.

Unit – IV:

Security of Emerging Technologies: Software-defined networking security, cloud security, security of Internet of Things, cyber-physical systems security, anonymous communication networks, peer-to-peer communication and digital payments, introduction to adversarial machine learning.

Unit – V:

Applied and Operational Security: Critical infrastructure security, ICS/SCADA, IT vs OT, basics of automotive and mobile security, wireless security concepts including IEEE 802.11i and WEP/WPA, and introduction to security practices such as ethical hacking and machine learning in cybersecurity.

Text Books:

1. Cryptography & Network Security: Behrouz A. Forouzan, Debdeep Mukhopadhyay, 3rd Edition MGH.
2. Computer and Information Security Handbook: John R Vacca, 3rd Edition MK.

Reference Books:

1. Cryptography and Network Security: William Stallings, Fifth Edition Pearson.
2. Network Security Essentials, Applications and Standards, William Stallings, Sixth Edition Pearson.
3. Industrial Cybersecurity: Efficiently Securing Critical Infrastructure Systems

Syllabus for Semester VIII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECT8002 – 3 **Course: RF Circuit Design (Program Elective – 7)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

At the end of this course students will demonstrate the ability to:

1. Understand the behavior of active and passive components at radio frequency
2. Implement filter in radio frequency domain.
3. Analyze active RF Component and analog communication circuits
4. Design Circuits, Dimensions and units in RF frequency spectrum.
5. Design Microstrip Transmission Lines and its analysis.

Unit I

Importance of radio frequency design, frequency spectrum, RF behavior of passive components: High frequency resistors, capacitors & inductors, Chip components and Circuit board considerations, Non-Linearity in RF Circuits, Noise in RF circuits, Insertion loss, Link Budget Calculation, Noise Figure, Sensitivity and Dynamic Range

Unit II

The Smith Chart- Reflection coefficient in Phasor form, Normalized Impedance equation, Parametric reflection coefficient equation, graphical representation, Impedance transformation for general load, Standing wave ratio, Special transformation conditions, Admittance Transformations

Unit III

RF Filter Design: Filter types and parameters, Low pass filter, High pass filter, Bandpass and bandstop filter, Insertion Loss, Special Filter Realizations, Filter Implementation: Unit Elements, Kuroda's Identities and Examples of Microstrip Filter Design.

Unit IV

Active RF Components and Biasing Networks, Matching Network, Microstrip lines Matching Network, LNA Topologies , Gain Switching , Band Switching , Nonlinearity Calculations

Unit V

Reciever and Transmitter Architectures, Transreceiver Architecture and performance specification, Recent Trends/Developments.

Text Books:

1. RF Circuit Design: Reinhold Ludwig, Pavel Bretchko, Pearson Education Asia.
2. RF Microelectronics: Behzad Razavi-McGraw Hill.

Reference Books:

1) Design of Analog CMOS integrated circuits: Behzad Razavi- McGraw Hill.
2) The Design of CMOS Radio Frequency Integrated Circuits: Thomas H. Lee- Cambridge University Pres

Syllabus for Semester VIII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP8003 **Course: Project**

L: 0 Hrs, T: 0 Hr, P: 12 Hrs. Per week **Total Credits: 06**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Implement project modules and circuit blocks initial/intermediate versions.
2. Test and validate individual project modules.
3. Integrate hardware and/or software modules for identified problems.
4. Lab-test and validate the modules of implemented project system.
5. Field-test the implemented system and summarize through presentation skills, publication and report writing.

The students will carry out following tasks for Project

1. In depth study of the topic assigned in the light of the Report prepared under Project Stage- I
2. Review and finalization of the Approach to the Problem relating to the assigned topic
3. Preparing an Action Plan for conducting the investigation, including team work
4. Detailed Analysis//Simulation/Design/Problem Solving/Experiment as needed
5. Final development of product/process, testing, results, conclusions and future directions
6. Preparing a paper for Conference presentation/Publication in Journals, if possible
7. Preparing a Dissertation in the standard format for being evaluated by the Department
8. Final Seminar Presentation before a Departmental Committee

Syllabus for Semester VIII, B. Tech. (Electronics and Communication Engineering)

Course Code: ECP8004 Course: Full Semester Industry Internship

L: 0 Hrs, T: 0 Hr, P: 24 Hrs. Per week Total Credits: 12

- The internship scheme will be available to undergraduate students of the department during the VII/VIII Semester.
- This scheme will provide students to undergo internship with stream majors at industry/well known academic institutions /R&D Laboratory premises and earn real world exposure.
- The student will be relieved for his/her internship at the start of the VII/VIII semester. Such students will appear for End Semester Examination along with other regular students of VIII semester as per the time-table provided by the institute.
- The evaluation will be done by industry mentor in coordination with the department.
- The head of department will assign a Mentor Faculty for a group comprising maximum four students each. The mentor faculty will also act as the Internal Supervisor for their respective projects in the industry.
- This internship scheme during VII/VIII Semester shall be offered subject to fulfillment of selection criteria by the student as decided by the department, grant of permission by industry /organization where internship is to be carried out, approval by head of department, availability of faculty and other requirements/constraints if any.
- On selection, it will be mandatory for the student to abide by the guidelines issued by department and the industry regarding internship.
- On completion, the student has to submit the internship report/s and internship completion certificate/s issued by the organization(s) where it was completed, to the department.
- The department will evaluate the same by way of Seminar/Viva-voce etc. in the department during VII/VIII Semester.

HONORS COURSES

Syllabus for Semester III, B. Tech.
(Electronics and Communication Engineering – HONORS)

Course Code: ECTH3100 **Course: Communication System Analysis (HONORS Course)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

After completion of this course, the students will be able to:

6. Describe the basic building blocks of communication systems.
7. Explain the concepts of advanced communication systems.
8. Apply convolution techniques in the context of communication signals
9. Demonstrate the application of software-defined radio (SDR) and cognitive radio in modern communication systems
10. Analyze the performance benefits of using spread spectrum techniques in communication systems

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Unit 1:

Introduction to Communication Systems

Basic building blocks of communication systems, overview of Analog and Digital communication systems, channel types, channel capacity, modeling, noise, performance indices.

Unit 2:

Signal Analysis

Applications of Fourier Transform, Properties, Autocorrelation, Energy Spectral Density, Convolution, Random Variables, Probability Density Functions in communication systems.

Unit 3:

Introduction to Wireless Communication

Basics of Cellular Systems, Wireless Channel Models, Large Scale Fading, Small Scale fading, Error Performance in AWGN and Fading channel, Multiple Access techniques.

Unit 4:

Spread Spectrum Communication Systems

Spreading sequences, Properties of Spreading Sequences, Pseudo- noise sequence, Orthogonal Sequences, Types of spread spectrum systems, probability of error.

Unit 5:

Modern Communication Systems

Introduction to 5G and Beyond, MIMO Systems and Spatial Diversity, Software-Defined Radio (SDR), Cognitive Radio, Communication System Security and Privacy

Textbooks

4. "Communication Systems" by Simon Haykin, 4th Edition, Wiley Publications
5. "Digital Communication" by John G. Proakis, McGraw Hill Publications
6. "Modern Wireless Communication" by K. Sam Shanmugan

Reference books:

4. Ke-Lin Du & M N S Swamy, "Wireless Communication System", Cambridge University Press, 2010
5. Behrouz A Forouzan, "Data Communications and Networking", 4th Edition, McGraw Hill.
6. William H. Tranter, K. Sam Shanmugan, T. S Rappaport, Kurt L. Kosbar, Principles of Communication System Simulation with Wireless Applications, 2011, 1st Edition, Prentice Hall Press, USA

Syllabus for Semester IV, B. Tech.
(Electronics and Communication Engineering – HONORS)

Course Code: ECTH4100 **Course: Multimedia Networks (HONORS Course)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes

After completion of this course, the students will be able to understand:

5. Functioning of circuit switched and packet switched networks
6. Reasons for emergence of converged communication networks
7. Various media coding algorithms and their applications
8. Emerging trends in multimedia networks.

Unit I
Review of circuit switched digital telephony, signaling and transmission, ISDN, SS7. Evolution of packet switched networks, Internet and LANs. The TCP/IP protocol stack.

Unit II
Introduction to XoIP, network convergence, Needs of individual users, enterprises and network operators. How XoIP is expected to meet all these concerns.

Unit III
Source coding (speech, audio and video coding) PCM, ADPCM, LP coding, CELP, RPE-LTP, adaptive sub-band coding, MPEG standards for audio and video coding.

Unit IV
Signaling protocols: Review of H.323, MEGACO protocols, Session Initiation Protocol (SIP), detailed study of SIP, implementation of SIP through Java.
Media Transport: Need of special media transport protocols, RTP, RTCP, RTSP, QoS issues, routing, security etc.

Unit V
Modern network technologies: Mobile communication 3G, 4G, IMS, wireless LANs, wired networks. New services like IP-TV, multimedia conference calls, presence management, device and access independent services. VXML based applications

Text Books:

1) O. Hersent, D. Gurle and JP Petit- "IP Telephony", Pearson Education Asia.
2) J. D. Gibson (Editor) "Multimedia Communications" – Harcourt India.

Reference Books:

3) Bill Douskalis "IP Telephony", Prentice Hall.
4) R. Wittman, M.Zitterbart-Morgan Kaufman, "Multicast Communication".

Syllabus for Semester V, B. Tech.
(Electronics and Communication Engineering – HONORS)

Course Code: ECTH5100 **Course: Cryptography and Information Security (HONORS Course)**

L: 4 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 04**

Course Objectives

The objective of this course is to make students aware of:

5. Basic concepts of Cryptography and Symmetric ciphers.
6. Security at different OSI layers.
7. Survey role of software in Information Security and defense mechanism against the attacks.
8. Access enforcement of security policies based upon leading standards of Information Security.

Course outcomes

After completion of this course, the students will be able to understand:

3. Fundamental concepts of Symmetric and Asymmetric Key Cryptography.
4. Various standard security protocols.
5. Different types of attacks and defenses against them.
6. How to write and enforce security policies based upon leading standards of Information Security.

Prerequisites – Computer Network (ECT357)

Unit I

Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Hashing and Digital Signatures, Symmetric ciphers and systems: Block and Stream, DES, AES.

Unit II

Security at different OSI layers: Physical Layer: Separated Networks, Data Diode; Application layer: PGP or S/MIME; Network layer: IPSec; Transport layer: SSL & TLS

Unit III

Introduction to Software and System Security: Buffer overflow and malicious software, Intrusion detection system, Firewall, DMZ. Common security problems including memory corruption, integer overflows, various injection attacks (command injection, SQL injection, XSS), Techniques to prevent and detect problems concerning software security.

Unit IV

Organizational Security: Information Technology and Security Management, Standards: ISO27001/ ISO27002/ISO27005, Risk Management

Unit V

Economics of Information Security: Rationality in behavior, Incentives and Externalities, Tragedy of commons, Market of lemons, Human factor in Information Security: Social Engineering/Phishing Campaigns

Unit VI

Future Verticals of Information Security:
Operational Security: Introduction to Critical Infrastructure Security, ICS/SCADA, IT VS OT.
Automotive Security: Overview of In-Vehicle Architecture, Threat Landscape, Security Mechanisms.
Mobile Security: Radio Access Network Security, Introduction to 2G/3G/4G security.
Wi-Fi Security: Open Access vs Private Network, IEEE802.11i WLAN, WEP/WPA Security.
*Recent Trends: Introduction to -Ethical Hacking/ Blockchain /Machine Learning in Cybersecurity

Text Books:

1) Cryptography & Network Security: Behrouz A. Forouzan, Debdeep Mukhopadhyay, 3rd Edition MGH.
2) Computer and Information Security Handbook: John R Vacca, 3rd Edition MK.

Reference Books:

3. Cryptography and Network Security: William Stallings, Fifth Edition Pearson.
4. Industrial Cybersecurity: Efficiently secure Critical Infrastructure security

Syllabus for Semester VI, B. Tech.
(Electronics and Communication Engineering – HONORS)

Course Code: ECTH6100 **Course: Evolution of Air Interface towards 5G (HONORS Course)**

L: 4 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 04**

Course Objectives

The objective of this course is to make students aware of:

5. Understand about the 5G radio access methodologies and spectrum
6. Comprehend about 5G architecture
7. Know millimeter wave technology
8. Gain knowledge about the features of 5G Technology

Course outcomes

After completion of this course students will be able to understand:

5. Describe the evolution of 5G, system concepts and spectrum challenges
6. Illustrate the architecture, Beamforming and hardware technologies for mmW communications
7. Describe and explain the requirements and fundamental techniques for MTC and D2D Communication
8. Illustrate and explain the fundamentals, resource allocation and transceiver algorithms for Massive MIMO

Prerequisite: Wireless Communication (ECT355 – 3)

Unit I

OVERVIEW OF 5G COMMUNICATION TECHNOLOGY

Historical Trend for Wireless Communication - Mobile Communications Generations: 1G to 4G – Evolution of LTE Technology to Beyond 4G – Standardization Activities -Use cases and Requirements – System Concept – Spectrum and Regulations: Spectrum for 4G – Spectrum Challenges in 5G – Spectrum Landscape and Requirements – Spectrum Access Modes and Sharing Scenarios

UNIT II

5G ARCHITECTURE AND MILLIMETER WAVE COMMUNICATION

5G Architecture: Software Defined Networking – Network Function Virtualization – Basics about RAN Architecture –High-Level Requirements for 5G Architecture – Functional Architecture and 5G Flexibility – Physical Architecture and 5G Deployment

UNIT III

MILLIMETER WAVE COMMUNICATION

Millimeter Wave Communication: Channel Propagation – Hardware Technologies for mmW Systems – Deployment Scenarios – Architecture and Mobility – Beamforming – Physical layer Techniques

UNIT IV

MACHINE TYPE AND D2D COMMUNICATION

MTC: Use cases and Categorization – MTC Requirements – Fundamental Techniques for MTC – Massive MTC –from 4G to 5G – Radio Resource Management for Mobile Broadband D2D – Multi-operator D2D Communication

UNIT V

5G RADIO ACCESS TECHNOLOGIES

Access Design Principles for Multi-user Communications – Multi-carrier with Filtering – Nonorthogonal Schemes for Efficient Multiple Access – Radio Access for Dense Deployments – Radio Access for V2X Communication – Radio Access for Massive Machine-type Communication.

UNIT VI

MASSIVE MULTIPLE-INPUT MULTIPLE –OUTPUT SYSTEMS

MIMO in LTE – Single-user MIMO – Multi-user MIMO – Capacity of Massive MIMO – Pilot Design of Massive MIMO – Resource Allocation and Transceiver Algorithms for Massive MIMO – Fundamentals of Baseband and RF Implementation in Massive MIMO – Channel Models

Text Books:

3. Fundamentals of 5G Mobile Networks, Publisher(s): Wiley, ISBN: 9781118867525
4. Asif Oseiran, Jose F. Monserrat and Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016.

Reference Books:

3. Jonathan Rodriquez, "Fundamentals of 5G Mobile Networks", Wiley, 2015
4. Patrick Marsch, Omer Bulakci, Olav Queseth and Mauro Boldi, "5G System Design – Architectural and Functional Considerations and Long Term Research", Wiley, 2018

MINOR COURSES

Syllabus for Semester III,

B. Tech. (Electronics and Communication Engineering – MINOR)

Course Code: ECTM3100 Course: Fundamentals of Communication Engineering (MINOR Course)

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

After completion of this course, the students will be able to:

1. Analyze various analog modulation schemes such as AM, FM etc.
2. Understand basics of Noise includes effect of noise on communication
3. Analyze various digital modulation schemes
4. Analyze recent communication technologies such as CDMA, GSM etc.

Unit I
Basic Communication System, Classification of electronic communication system, Need of modulation, Principles of Amplitude Modulation Systems- DSB, SSB, Angle Modulation, Representation of FM and PM signals.

Unit II
Introduction to Noise, Types of Noise, Noise Calculation, Noise factor, Noise Temperature, Pre-Emphasis and De-Emphasis

Unit III
Pulse modulation, Pulse code modulation (PCM), Differential pulse code modulation, Delta modulation and Adaptive Delta Modulation

Unit IV
Digital Modulation schemes- Amplitude shift Keying, Phase Shift Keying, and Frequency Shift Keying.

Unit V
Spread – Spectrum Communication: - Study of PN sequences, direct sequence methods, Frequency hop methods, slow and fast frequency hop.
Code Division Multiple Access (CDMA), GSM, LTE, Recent Trends/Developments

Text Books:

3. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
4. B. P. Lathi, “Modern Digital and Analog Communication Systems”, Third Edition, Oxford University press.

Reference Books:

7. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
8. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.
9. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley, 1965.
10. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
11. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.
12. George Kenndey, 4th Edition , " Electronics Communication systems "

Syllabus for Semester IV,

B. Tech. (Electronics and Communication Engineering – MINOR)

Course Code: ECTM4100 **Course: Sensors for Smart City (MINOR Course)**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes:

After completion of this course, the students will be able to:

5. Employ the knowledge of mathematics, science, and engineering to understand fundamentals of sensor systems.
6. Understand the applications of sensors in smart cities.
7. Learn IEEE Standards for advance Sensors
8. Comprehend actuating devices for sensor systems.

UNIT I

Smart City: Concept, Definition, Criteria for smart cities, Smartness (Eg. Environment, Mobility, Economy, Utilities, Transportation, road Infrastructure, Health Care etc.)

Unit II

Sensor Characteristics: Transfer function, accuracy, calibration, hysteresis, nonlinearity, saturation, repeatability, dead band, resolution, output impedance, excitation, dynamic characteristics, environmental factors, reliability and application characteristics.

Unit III

Review of transducers for various parameters (like temperature, pressure, flow, level, humidity, acceleration, vibration etc.), Sensor Materials and overview of sensor technologies: Silicon as Sensing Material, Plastics, Metals, Ceramics, Glasses, Optical Glasses, Nano-materials, Overview of Surface Processing technologies.

Unit IV

IEEE Standards for advance Sensors: Fundamentals, IEEE 1451 standard for smart sensors, Sensor Signals and Systems, Sensor specifications, Sensor Characteristics, Physical principles of sensing.

Unit V

Applications: Smart street lighting, Smart Parking, Environmental pollution monitoring, Vehicular tracking, Smart Traffic Control, Waste Management, Smart Grid, Smart Cars, Smart Homes, Smart Domestic Appliances, Smart Toys etc.

TEXT BOOKS:

5. D.V.S.Murty, "Transducers and Instrumentation", Second edition, PHI publication, Second edition, 2010.
6. Randy Frank, "Understanding Smart Sensors", Artech House Inc., 2nd Edition.
7. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs, and Applications", Springer; 4th editon.
8. Carlo Ratti and Matthew Claudel, ―The City of Tomorrow: Sensors, Networks, Hackers, andthe Future of Urban Life (The Future Series), Yale University Press.

REFERENCE BOOKS:

4. Mohammad Hammoudeh & Mounir Arioua, "Sensors and Actuators in Smart Cities" (Open Access book) MDPI, Basel, Switzerland.
5. Gerard Meijer, "Smart sensor systems", Wiley, 2008
6. W Gopel, J. Hesse, J. N. Zemel, "Sensors A Comprehensive Survey" Vol. 9, Wiley-VCH, 1995

Syllabus for Semester V,

B. Tech. (Electronics and Communication Engineering – MINOR)

Course Code: ECTM5100 **Course: IoT for Industrial Application (MINOR Course)**

L: 4 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 04**

Course Objectives

The objective of this course is to make students aware of:

4. IoT scope and its applications
5. Hands on experience with Raspberry pi SBC
6. Python Programming and Linux environment

Course outcomes

After completion of this course students will be able to:

5. Understand the scope of IoT.
6. Explore the linux environment for SBC (Single Board Computer)
7. Demonstrate IoT based applications on Raspberry Pi
8. Use Python-based IDE and trace and debug Python code on the Raspberry Pi for IoT applications.

Unit I

Introduction to Internet of Things: Concept and its need, architecture, scope and applications, Overview of Networking and protocols applicable to IoT.

Unit II

Exploring the platforms/ hardware for IoT: Getting Started with Raspberry Pi, Basic and functionality of the Raspberry Pi board and its Processor, setting and configuring the board, differentiating Raspberry Pi from other platform like Arduino, Over-clocking, Component overview.

Unit III

Introduction to Linux: Implications of an operating system on the behaviour of the Raspberry Pi, Overview of Linux and its terminal command, apt-get-update, apt-get-upgrade, navigating the file system and managing processes, text-based user interface through the shell, overview of graphic user interface.

Unit IV

Programming the Raspberry Pi: Python: Introduction to Python programming language : Python Programming Environment, Python Expressions, Strings, Functions, Function Arguments, Lists, List Methods, Control Flow, Numpy, PIP (Python Installation Package) and customized libraries.

Unit V

Sensors and Actuators (Light Sensors, Ultrasonic, Temperature and humidity,etc) for IoT, Wired and Wireless communication, Communication facilities on raspberry Pi (I2C, SPI, UART), working with RPi. GPIO library, Communication Using Raspberry Pi for IoT applications.

Unit VI

Applications of IoT: case studies based on Commercial products, Applications / Product Development of IoT based application

Text Books:

1) Designing the Internet of Things, Adrian McEween and Hakim Cassimally, 1st Edition John Wiley and Sons, Ltd.

Reference Books:

5. Learning of Internet of Things, Peter Waher, 1st Edition Packet Publishing.
6. Raspberry Pi 3 : An Introduction to Using with PythonScratch, Javascript and more, Gary Mitnick, CreateSpace Independent Publishing Platform, 2017.
7. Raspberry Pi for Python Programmers Cookbook, Tim Cox, Packt Publishing Limited; 2nd Revised edition, 2016.
8. Raspberry Pi User Guide, Eben Upton and Gareth Halfacreee, John Wiley & Sons, 2016

Syllabus for Semester VI,

B. Tech. (Electronics and Communication Engineering – MINOR)

Course Code: ECTM6100 **Course: Future Generation Networks (MINOR Course)**

L: 4 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 04**

Course Objectives

The objective of this course is to make students aware of:

4. Fundamentals of wireless communications
5. Existing and emerging wireless communications networks
6. Evolution of wireless networks from the first generation to LTE and LTE advanced, 5G

Course outcomes

After completion of this course students will be able to:

5. Understand diversity techniques to improve performance
6. Describe current and future cellular mobile communication systems
7. Learn 3G and 4G Major Technical Standards
8. Describe the characteristics of the OFDM, 5G system concepts

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UNIT I

Overview of wireless communications and systems, Review of digital communications, Cellular systems from 1G to 3G

UNIT II

Wide-area wireless networks (WANs),3G and 4G Wireless Standards- GSM, GPRS, WCDMA

UNIT III

Long Term Evolution Technologies (LTE), OFDM, MIMO channels, LTE Advanced

UNIT IV

OFDM -Introduction, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues

UNIT V

MIMO -Introduction, MIMO Channel Capacity, Other Wireless systems IEEE 802.11, WLAN (Wi-Fi) WiMAX

UNIT VI

5G – Introduction, Architecture, Basics about RAN Architecture, Physical Architecture and 5G Deployment

Text Books:

4. Wireless Communication, Rappaport, 2nd Edition Pearson
5. Mobile Wireless Communications, Mischa Schwartz. Paperback (2013) ISBN: 978110741271
6. Cambridge University Press. References: The evolution to 4G cellular systems: LTE-Advanced. Ian F. Akyildiz, David M. Gutierrez Estevez, Elias Chavarria Reyes.

Reference Books:

3. Iti Saha Misra, "Wireless Communication and Networks – 3G and Beyond", Mc Graw Hill Education, Second Edition, 2013.
4. Jochen Schiller, "Mobile Communications", Pearson Education, Second Edition, 2012.