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RAMDEOBABA UNIVERSITY, NAGPUR
Formerly Shri Ramdeobaba College of Engineering & Management (RCOEM) Est. 1984

RAMDEOBABA UNIVERSITY, NAGPUR-440013

Established by the Maharashtra Private Universities (Establishment and Regulation) Act 2023
(Mah. Act No VIII of 2024)

Formerly, Shri Ramdeobaba College of Engineering and Management, Nagpur 440013

School of Electrical and Electronics Engineering

Department of
(Electronics and Communication Engineering)

PROGRAMME SCHEME & SYLLABI

as per National Education Policy (NEP)

(With effect from Academic Year **2024-25**)

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:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for

- i. independent and life-long learning
- ii. adaptability to new and emerging technologies and
- iii. critical thinking in the broadest context of technological change. (WK8)

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	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	BSC	24HS05TH0103	Semiconductor Physics	3	0	3	50	50	100	3
2	BSC	24HS05PR0103	Semiconductor Physics Lab	0	2	1	25	25	50	-
3	BSC	24HS03TH0101	Calculus, Probability and Statistics	3	0	3	50	50	100	3
4	BSC	24HS03PR0102	Computational Mathematics Lab	0	2	1	25	25	50	-
5	PCC	24EE05TH0101	Digital Circuits	3	0	3	50	50	100	3
6	PCC	24EE05PR0101	Digital Circuits Lab	0	2	1	25	25	50	-
7	ESC	24EE05TH0102	Fundamentals of Electrical and Electronics Engineering	3	0	3	50	50	100	3
8	ESC	24EE05TH0103	Fundamentals of Programming	2	0	2	50	50	100	2
9	ESC	24EE05PR0103	Fundamentals of Programming Lab	0	2	1	25	25	50	-
10	AEC	24HS02TH0101	English for Professional Communication	2	0	2	50	50	100	2
11	AEC	24HS02PR0101	English for Professional Communication Lab	0	2	1	25	25	50	-
12	VEC	24HS02TH0104	Foundational course in Universal Human Values	1	0	1	50	0	50	-
			TOTAL	17	10	22				

Semester II

Sr. No.	Course Type	Code	Course	Hours/ week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	BSC	24HS03TH0211	Linear Algebra and Multivariate Calculus	3	0	3	50	50	100	3
2	PCC	24EE05TH0201	Electronic Devices and Circuits	3	0	3	50	50	100	3
3	PCC	24EE05PR0201	Electronic Devices and Circuits Lab	0	2	1	25	25	50	-
4	ESC	24EE05TH0202	Network Theory	3	0	3	50	50	100	3
5	ESC	24EE05PR0203	Electronics and Computer Workshop	0	2	1	25	25	50	-
6	VSEC	24EE05TH0204	Object Oriented Programming and Data Structures	3	0	3	50	50	100	3
7	VSEC	24EE05PR0204	Object Oriented Programming and Data Structures Lab	0	2	1	25	25	50	-
8	VEC	24HS01TH0202	Environmental Science	1	0	1	50	-	50	-
9	VEC	24HS01PR0202	Environmental Science Lab	0	2	1	25	25	50	
10	IKS	24HS02TH0203	Foundational Literature of Indian Civilization	1	0	1	50	-	50	-
11	CCA	24HS04PR0201	Sports-Yoga-Recreation Lab	0	2	1	25	25	50	-
12	CCA	24HS02PR0206	Liberal/Performing Art Lab	0	2	1	25	25	50	-
			TOTAL	14	12	20				

Liberal/Performing Art Lab		
Sr. No.	Course Code	Course Name
1	24HS02PR0206-01	Fundamentals of Indian Classical Dance: Bharatnatayam
2	24HS02PR0206-02	Fundamentals of Indian Classical Dance: Kathak
3	24HS02PR0206-03	Introduction to Digital Photography
4	24HS02PR0206-04	Introduction to Basic Japanese Language
5	24HS02PR0206-05	Art of Theatre
6	24HS02PR0206-06	Introduction to French Language
7	24HS02PR0206-07	Introduction to Spanish Language
8	24HS02PR0206-08	Art of Painting
9	24HS02PR0206-09	Art of Drawing
10	24HS02PR0206-10	Nature camp
11	24HS02PR0206-11	Developing Self Awareness
12	24HS02PR0206-12	Art of Poetry
13	24HS02PR0206-13	Creative and Content Writing
14	24HS02PR0206-14	Science of Life through Bhagwad Gita
15	24HS02PR0206-15	Sanskrit Sambhashan – Spoken Sanskrit
16	24HS02PR0206-16	Kirtan Kala
17	24HS04PR0202-1	Adventure Sports
19	24HS04PR0202-2	Introduction to Defense Forces & Obstacle Training
16	24HS04PR0202-3	Self Defense and Indian Martial Arts (Girls)
20		Self Defense and Indian Martial Arts (Boys)
21	24HS04PR0202-4	Basic Nutritional Course
22	24HS04PR0202-5	Disaster Management
23	24HS01PR0203	Remedies by Ayurveda
24	24HS01PR0204	Biodegradation of Kitchen Waste
25	24HS05PR0205	Herbal Home Remedies : A course for self care
26	24EE07PR0205	Day-to-Day Electrical Systems

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 / MOOC OR Technical Project OR One Month Internship at Industry

**Scheme of Teaching & Examination of Bachelor of Technology
Electronics and Communication Engineering**

Semester III

Sr. No	Course Type	Code	Course	Hours/ week		Credits	Maximum Marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PCC	24EE05TH0301	Digital system Design with HDL	3	0	3	50	50	100	3
2	PCC	24EE05PR0301	Digital system Design with HDL Lab	0	2	1	25	25	50	-
3	PCC	24EE05TH0302	Analog Circuit Design	3	0	3	50	50	100	3
4	PCC	24EE05PR0302	Analog Circuit Design Lab	0	2	1	25	25	50	-
5	PCC	24EE05TH0303	Signals and Systems	3	0	3	50	50	100	3
6	PCC	24EE05TH0304	Microcontrollers & Peripherals	3	0	3	50	50	100	3
7	PCC	24EE05PR0304	Microcontrollers & Peripherals Lab	0	2	1	25	25	50	-
8	OE	24EEOEI05TH0305	Open Elective – 1/ MOOC	2	0	2	50	50	100	2
9	MDM	24EE05TH0306	MDM – 1	3	0	3	50	50	100	3
			TOTAL	17	6	20				

Semester IV

Sr. No.	Course Type	Course Code	Course Name	Hours/ week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PCC	24EE05TH0401	Electromagnetic Fields	3	0	3	50	50	100	3
2	PCC	24EE05TH0402	Analog and Digital Communication	3	0	3	50	50	100	3
3	PCC	24EE05PR0402	Analog and Digital Communication Lab	0	2	1	25	25	50	-
4	PCC	24EE05TH0403	Computer Communication Networks	3	0	3	50	50	100	3
5	PCC	24EE05PR0403	Computer Communication Networks Lab	0	2	1	25	25	50	-
6	PCC	24EE05TH0404	Digital Signal Processing	3	0	3	50	50	100	3
7	PCC	24EE05PR0404	Digital Signal Processing Lab	0	2	1	25	25	50	-
8	ESC	24EE05PR0405	Fundamentals of Linux	0	2	1	25	25	50	-
9	SEC	24EE05PR0406	Skill Enhancement Course – I	0	2	1	25	25	50	-
10	OE	24EEOEI05TH0407	Open Elective – 2/ MOOC	2	0	2	50	50	100	2
11	MDM	24EE05TH0408	MDM – 2	3	0	3	50	50	100	3
			TOTAL	17	10	22				

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/ MOOC

OR

Technical Project

OR

One Month Internship at Industry

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

Semester V

Sr No.	Course Type	Course Code	Course Name	Hours/ week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PCC	24EE05TH0501	Embedded Systems	3	0	3	50	50	100	3
2	PCC	24EE05PR0501	Embedded Systems Lab	0	2	1	25	25	50	-
3	PCC	24EE05TH0502	CMOS VLSI Design	3	0	3	50	50	100	3
4	PCC	24EE05PR0502	CMOS VLSI Design Lab	0	2	1	25	25	50	-
5	PCC	24EE05TH0503	Probability Theory and Random Processes	3	0	3	50	50	100	3
6	VSEC	24EE05PR0504	System Design Workshop	0	4	2	50	50	100	-
7	PEC	24EE05TH0505	Program Elective – 1	3	0	3	50	50	100	3
8	AEC	24HS02TH0501	Business Communication	1	0	1	50	-	50	-
9	AEC	24HS02PR0501	Business Communication Lab	0	2	1	25	25	50	-
10	OE	24EEOEI05TH0506	Open Elective – 3/ MOOC	2	0	2	50	50	100	2
11	MDM	24EE05TH0507	MDM – 3	3	0	3	50	50	100	3
			TOTAL	18	10	23				

Program Elective – 1	
Course Code	Course Name
24EE05TH0505 – 1	Control Systems
24EE05TH0505 – 2	Data Structures and Algorithms
24EE05TH0505 – 3	Information Theory and Coding

Semester VI

Sr. No.	Course Type	Course Code	Course Name	Hours/ week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PCC	24EE05TH0601	Wireless Communication	3	0	3	50	50	100	3
2	PEC	24EE05PR0601	Wireless Communication Lab	0	2	1	25	25	50	-
3	PCC	24EE05TH0602	Machine Learning	3	0	3	50	50	100	3
4	PCC	24EE05PR0602	Machine Learning Lab	0	2	1	25	25	50	-
5	PCC	24EE05TH0603	Internet of Things	3	0	3	50	50	100	3
6	PCC	24EE05PR0603	Internet of Things Lab	0	2	1	25	25	50	-
7	PEC	24EE05TH0604	Program Elective – 2	3	0	3	50	50	100	3
8	PEC	24EE05TH0605	Program Elective – 3	3	0	3	50	50	100	3
9	SEC	24EE05PR0606	Skill Enhancement Course – II	0	2	1	25	25	50	-
10	PRJ	24EE05PR0607	Project Phase – I	0	4	2	50	50	100	-
11	MDM	24EE05TH0608	MDM – 4	3	0	3	50	50	100	3
			TOTAL	18	12	24				

Program Elective – 2	
Course Code	Course Name
24EE05TH0604 – 1	Smart Sensors
24EE05TH0604 – 2	Design and Analysis of Algorithms
24EE05TH0604 – 3	Radiating Systems

Program Elective – 3	
Course Code	Course Name
24EE05TH0605 – 1	System Verilog
24EE05TH0605 – 2	Database Management Systems
24EE05TH0605 – 3	Speech and Audio Processing

Exit option 3	
(Additional 8 Credits)	
Offline/Online (ESSC-India / NSQF skill) Course on – PC Hardware and Computer networking / Embedded system design IoT or similar course/ MOOC 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	Code	Course	Hours/ week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PCC	24EE05TH0701	5G and Next Generation Communication Systems	3	0	3	50	50	100	3
2	PCC	24EE05TH0702	Computer Architectures and Parallelism	3	0	3	50	50	100	3
3	PCC	24EE05TH0703	Digital Image Processing	3	0	3	50	50	100	3
	PCC	24EE05PR0703	Digital Image Processing Lab	0	2	1	25	25	50	-
4	PEC	24EE05TH0704	Program Elective 4	3	0	3	50	50	100	3
5	PEC	24EE05TH0705	Program Elective 5	3	0	3	50	50	100	3
6	CEP	24EE05PR0706	*Participative Learning	0	2	1	25	25	50	-
7	PRJ	24EE05PR0707	Project Phase – II	0	4	2	50	50	100	-
			TOTAL	15	8	19				

***Floating Credits:** To be acquired before VII Semester

Program Elective - 4	
Course Code	Course Name
24EE05TH0704 – 1	VLSI Technology
24EE05TH0704 – 2	Software Engineering
24EE05TH0704 – 3	RTOS and Kernels

Program Elective - 5	
Course Code	Course Name
24EE05TH0705 – 1	Introduction to MEMS
24EE05TH0705 – 2	Computer Vision
24EE05TH0705 – 3	Wireless Sensor Networks

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	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PEC	24EE05TH0801	Program Elective 6	3	0	3	50	50	100	3
2	PEC	24EE05TH0802	Program Elective 7	3	0	3	50	50	100	3
3	PRJ	24EE05PR0803	Project Phase – III	0	12	6	50	50	100	-
			TOTAL	6	12	12				
OR										
4	INT	24EE05PR0804	Full Semester Internship	0	24	12	100	100	200	-

Program Elective - 6	
Course Code	Course Name
24EE05TH0801 – 1	RF Circuit Design
24EE05TH0801 – 2	Deep Learning
24EE05TH0801 – 3	Microwave Theory and Techniques

Program Elective - 7	
Course Code	Course Name
24EE05TH0802 – 1	Design for Testability
24EE05TH0802 – 2	Artificial Intelligence
24EE05TH0802 – 3	Cryptography and Network Security

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	24EE05TH0708	NPTEL/ Online Courses	3	0	3	50	50	100	-
2	PEC	24EE05TH0709	NPTEL/ Online Courses	3	0	3	50	50	100	-
3	PEC	24EE05TH0710	NPTEL/ Online Course	3	0	3	50	50	100	
4	PEC	24EE05TH0805	NPTEL/ Online Course	2	0	2	50	50	100	
5	PRJ	24EE05PR0806	Full Year Internship	0	40	20	200	200	400	-
			TOTAL	11	40	31				

Students are required to earn total **11 credits** through NPTEL, Coursera or Global Certification Providers.

NOTE:

- Student shall select courses defined and approved by Board of Studies (BoS) of Electronics and Communication Engineering Department, on platforms such as NPTEL, Coursera or Global Certification Providers. The selection and approval shall be finalized at least one week before the start of internship period.
- Selected Courses must not have been covered in any earlier semester.

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

Sem	Course Code	Name	L	P	Cr	Continuous Assessment	ESE	Total	ESE Duration
III	24EE05HT0301	Communication System Analysis	3	0	3	50	50	100	3
IV	24EE05HT0401	Multimedia Networks	3	0	3	50	50	100	3
V	24EE05HT0501	Advanced Digital Communication	4	0	4	50	50	100	3
VI	24EE05HT0601	Millimeter Wave Communication	4	0	4	50	50	100	3
VII	24EE05HP0701	Project	0	8	4	50	50	100	3
		TOTAL	14	8	18				

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

Sem	Course Code	Name	L	P	Cr	Continuous Evaluation	End Sem/ Internal Eval	Total	ESE Duration
VII	24EE05HT0701	Research Methodology	3	0	3	50	50	100	3
VII	24EE05HP0702	Research Project Phase – I	0	6	3	50	50	100	-
VIII	24EE05HP0801	Research Project Phase – II	0	24	12	50	50	100	-
		TOTAL	3	30	18				

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

Sem	Code	Name of the course	L	P	Cr	Continuous Assessment	ESE	Total	ESE Duration
III	24EE05MT0301	Fundamentals of Communication Engineering	3	0	3	50	50	100	3
IV	24EE05MT0401	Sensors for Intelligent Instrumentation	3	0	3	50	50	100	3
V	24EE05MT0501	IoT for Industrial Application	4	0	4	50	50	100	3
VI	24EE05MT0601	Future Generation Networks	4	0	4	50	50	100	3
VII	24EE05MP0701	Project	0	8	4	50	50	100	3
		TOTAL	14	8	18				

List of Program Elective Courses

Semester	Domain Name		
	VLSI	Computer Science	Communication/ Signal Processing
V	Control Systems	Data Structures and Algorithms	Information Theory and Coding
VI	Smart Sensors	Design and Analysis of Algorithms	Radiating Systems
	System Verilog	Database Management Systems	Speech and Audio Processing
VII	VLSI Technology	Software Engineering	RTOS and Kernels
	Introduction to MEMS	Computer Vision	Wireless Sensor Networks
VIII	RF Circuit Design	Deep Learning	Microwave Theory and Techniques
	Design for Testability	Artificial Intelligence	Cryptography and Network Security

Multi Disciplinary Minor (MDM)
Track: Embedded systems and IoT

Semester	MDM	Course	Course Code
III	MDM – 1	Sensors for IoT	24EE05TH0306-1
IV	MDM – 2	Microcontrollers and IoT Applications	24EE05TH0408-1
V	MDM – 3	IoT System Architecture	24EE05TH0507-1
VI	MDM – 4	Use Cases of IoT	24EE05TH0608-1

Multi Disciplinary Minor (MDM)
Track: Communication Engineering

Semester	MDM	Course	Course Code
III	MDM – 1	Fundamentals of Communication	24EE05TH0306-2
IV	MDM – 2	Mobile Communication	24EE05TH0408-2
V	MDM – 3	LTE Technologies	24EE05TH0507-2
VI	MDM – 4	5G and 6G Systems	24EE05TH0608-2

I SEMESTER

SYLLABUS FOR SEMESTER I

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]
Course Code: 24HS05TH0103 **Course: Semiconductor Physics**
L: 3 Hrs. P: 0 Hrs. per week **Total Credits: 3**

Course Outcomes

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

1. Apply fundamental knowledge of quantum mechanics to examine electrons behavior in solids at the quantum level.
2. Classify materials on the basis of band theory and its importance for semiconductors.
3. Outline the difference between intrinsic and extrinsic semiconductors and explain their carrier transport phenomena in semiconductor.
4. Illustrate the working and design aspects for the various photonic devices like LEDs, solar-cells and LASER diodes.
5. Analyze the simple harmonic oscillator, damped oscillator and forced oscillator.

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, p-n junction diode, Zero-applied bias, forward bias, reverse bias.

Unit 5: Optoelectronic Devices

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

Unit 6: Oscillations

Quick review of simple harmonic motion, mechanical and electrical oscillators, vector and complex numbers, Phasor representation, damped oscillations: under, critical and over damping, forced oscillations, impedance, energy and power supplied by driving force, Q-factor, related numerical/problems.

Text Book(s):

1. Semiconductor Physics and Devices (Fourth Edition), Donald A. Neamen, McGraw-Hill 2012.
2. Optoelectronics and Photonics: Principles and Practices by S. O. Kasap, Prentice Hall 2001
3. The Physics of Vibrations and Waves (Sixth Edition), H J Pain John-Wiley 2005.

References:

1. Physics of Semiconductor Devices, Simon M. Sze, Wiley-Interscience (1981)
2. Semiconductor Device Physics and Design, Umesh K Mishra and Jasprit Singh, Springer 2008.

SYLLABUS FOR SEMESTER I

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]
Course Code: 24HS05PR0103 **Course: Semiconductor Physics Lab**
L: 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. Analyze 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 a basic PN Junction, Zener Diode and other optoelectronic devices.
5. Prepare laboratory reports on interpretation of experimental results

List of Experiments:

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

Reference:

1. Laboratory manual of the Physics Department
2. Principles and Practices by S. O. Kasap, Prentice Hall 2001

SYLLABUS FOR Semester I

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24HS03TH0101
L: 3 Hrs., P: 0 Hrs., Per week

Course Name: Calculus, Probability and Statistics
Total Credits: 03

Course Outcomes:

On successful completion of the course, the students will be 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. Internalize multivariable calculus and apply it to find Jacobians, maxima and minima of function.
 5. Recognize and understand discrete, continuous probability distributions and apply Binomial distribution, Poisson distribution and Normal distribution to appropriate problems.
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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's type, 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)

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

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. Spiegel, Schaum series
8. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).
9. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

SYLLABUS FOR B. Tech Semester I

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]
Course Code: 24HS03PR0102 **Course: Computational Mathematics Lab**
L: 0 Hr., P: 2 Hrs., Per week **Total Credits:1**

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	Applied optimization with SageMath	CO3
5	Analysis of solutions of differential equations in SageMath	CO3
6	Linear Algebra with Various applications	CO5
7	Curve Fitting to identify trends and patterns within dataset by using SageMath	CO6
8	Practical Applications of Integral Calculus with SageMath	CO4

Syllabus for Semester I

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE05TH0101

Course: Digital Circuits

L: 3 Hrs, P: 0 Hrs. Per week

Total Credits: 03

Course Outcomes

On completion of this course students will be able to:

1. Explain different logic families.
 2. Perform number system conversions
 3. Implement Boolean equations using logic gates.
 4. Design different types of combinational circuits.
 5. Design asynchronous and synchronous sequential circuits.
-

Module I

Basics of Digital Electronics: Motivation for digital systems, Number Systems and Digital Codes (conversion and arithmetic), representation of signed numbers, Boolean algebra, SOP, POS forms, Karnaugh-maps, Introduction to Logic family

Module II

Timing Issues in Digital Circuit: Fan-In, Fan-Out, Propagation Delay, Power dissipation, Noise Margin, Timing issues

Module III

Combinational Circuit Design: Multiplexers, De-multiplexers, Encoders, Decoders, Code Converters, Adders, Subtractor, BCD Adder/Subtractor, comparator.

Module IV

Sequential Circuit: Latches, Flip Flops – RS, D, JK, Master Slave JK, T flip flop, their excitation and truth table, Conversion of one Flip Flop to another, Timing and Clocking issues.

Module V

Sequential circuits Design: Design of asynchronous and synchronous counters, Shift Registers, Application of shift register

Module VI

Design of synchronous sequential circuit using Mealy model and Moore model: state transition diagram, State encoding techniques, State reduction techniques

Text books:

1. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 1989.
2. Modern Digital Electronics: R. P Jain, Tata McGraw Hill, 3rd Edition.

ReferenceBooks:

1. Digital Logic and Computer Design: Morris Mano, PHI, 3rd Edition.

Syllabus for Semester I

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE05PR0101

Course: Digital Circuits Lab

L: 0 Hrs, P: 2 Hrs. Per week

Total Credits: 01

Course outcomes

On completion of this course students will be able to:

1. Verify Truth Table of Logic Gates.
 2. Implement Boolean Identities.
 3. Implement combinational circuits.
 4. Implement sequential circuits.
 5. Design code converters using logic gates.
-

1. To verify the truth table of different logic gates.
2. Design basic logic gates using universal gate and verify its truth table.
3. To verify the following Boolean expressions using logic gates and Multisim software.
 - a) $A + A'B + AB$
 - b) $AB(C + AC)$
4. To implement the following arithmetic circuits using (a) logic gates IC's and (b) using Multisim software.
 - a) Full adder
 - b) Half subtractor
5. Implement the function $F = \sum m(1, 3, 5, 7, 8, 9, 11, 13, 15)$ using 16:1 and 8:1 multiplexer.
6. Verify the truth table of SR, JK, JKMS, T and D flip flop.
7. To study and analyse the following functions of Shift register using IC 7495
 - a) SIPO
 - b) PIPO
 - c) PISO
 - d) SISO
8. Design and verify 2-bit synchronous down counter using S-R flip-flop.
9. Design and verify the functionality of a sequence detector to detect the sequence 1101 using Melay and Moore model and use J-K flip-flop to implement the design.

Syllabus for Semester I

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE05TH0102

**Course: Fundamentals of Electrical and
Electronics Engineering**

L: 3Hrs, P: 0 Hrs. Per week

Total Credits: 03

Course Outcomes

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

1. Apply the knowledge of basic laws to analyze simple DC circuits.
 2. Construct and analyze the behavior of simple AC circuits.
 3. Apply the knowledge of transformer operation to calculate and analyze different parameters, including voltage, current, efficiency and losses.
 4. Calculate the performance parameters of induction motors and utilize them for various applications.
 5. Identify, characterize diodes and analyze their behavior in simple electronic circuits.
-

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)

Single Phase Transformer: 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.

Module V: (6 Hours)

PN diode operation: forward bias and reverse bias , Volt-Ampere characteristics of p-n diode, Temperature dependence of VI characteristics, Current components in p-n diode,

Diode equation, Transition and Diffusion capacitances, Breakdown Mechanisms in Semiconductor diodes, Rectifiers: half wave and full wave, Wave shaping circuits

Module VI: (6 Hours)

Special Purpose diodes and their applications: Zener diode characteristics and application, Tunnel Diode, LED, LDR, Varactor, Photo diode, PIN diode, Schottky diode, LASER, Applications.

Text books

1. Basic Electrical and Electronics Engineering by S.K.Bhattacharya, Pearson Publications
2. Basic Electrical and Electronics Engineering by D.P. Kothari and I J Nagrath, TMH.
3. A Textbook of Electrical Technology, Volume I and II, B.L. Thereja, S. Chand Publications, 2005
4. Basic Electrical Engineering, D.C. Kulshreshtha, McGraw Hill, 2009.
5. Basic Electrical Engineering: S.B. Bodkhe, N.M. Deshkar, P.P.H. Pvt. Ltd. Second Edition, 2008

Reference Books

1. Basic Electrical Engineering by Fitzgerald and Higginbotham, TMH.
2. Basic Electrical Engineering by I.J Nagrath, TMH.
3. Millman's Integrated Electronics: Jacob Millman, Christos Halkias, Chetan Parikh, McGraw Hill

Syllabus for Semester I

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE05TH0103
L: 2 Hrs, P: 0 Hrs. Per week

Course: Fundamentals of Programming
Total Credits: 02

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.
-

Module 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.

Module 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.

Module 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.

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

Text Books:

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

Reference Books:

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

Syllabus for Semester I

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE05PR0103

Course: Fundamentals of Programming Lab.

L: 0 Hrs, P: 2 Hrs. Per week

Total Credits: 01

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 & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24HS02TH0101

Course: English for Professional Communication

L: 2 Hrs, P: 0Hr, Per Week

Total Credits: 2

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.

Module-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

Module -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.

Module -3: Functional Grammar and Usage

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

3.2 Tenses

3.3 Subject-verb agreement, noun-pronoun agreement

3.4 Voice

Module-4: Writing Skills

4.1 Sentence Structures

4.2 Sentence Types

4.3 Paragraph Writing: Principles, Techniques, and Styles

Module-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 Heasley. Cambridge University Press. 2006.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Syllabus for Semester I

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24HS02PR0101

Course: English for Professional Communication Lab

L: 0 Hrs, P: 2Hr, Per Week

Total Credits: 1

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 & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24HS02TH0104

Course: Foundational course in Universal Human Value

L: 1 Hrs P: 0 Hr, Per Week

Total Credits: 1

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:

Module 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.

Module 2:- Health

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

Module 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 Scheme and Syllabus B. Tech. Electronics and Communication Engineering (RBU)

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

B. Tech Semester II

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24HS03TH0211

Course Name: Linear Algebra and Multivariate Calculus

L: 3Hrs, P: 0 Hrs, Per week

Total Credits: 03

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.
-

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) (7 hours)

Scalar point function, Vector point function, vector differentiation, gradient, divergence and curl, directional derivatives with their physical interpretations, solenoidal and irrotational motions, Scalar potential function.

Module 5: Vector Calculus (Integration) (7 hours)

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.

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 VidhyarthiGrihaPrakashan, Pune-411030 (India).
6. Biomedical Statistics –ShantikumarYadav,Sompal Singh, Ruchika Gupta
7. Theory and Problems of Probability and Statistics - M.R. Spiegel (McGraw Hill) Schaum Series

Syllabus for Semester II,

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE05TH0201

L: 3 Hrs, P: 0 Hrs. Per week

Course: Electronic Devices and Circuits

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 and their applications.
 2. Comprehend the fundamentals of feedback amplifiers.
 3. Apply biasing techniques in amplifiers.
 4. Estimate performance parameters of amplifiers.
 5. Analyze the need of multistage amplifiers.
-

Module I

Transistors and Biasing: AC/DC load line concept, Operating Point Analysis, need of biasing, biasing techniques, bias stabilization, compensation techniques, Application of BJT as Amplifier, Introduction to h-parameters, Introduction JFET and MOSFET

Module II

Feedback Amplifiers: Feedback Topologies, effect of feedback on bandwidth, gain, stability.

Module III

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.

Module IV

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

Module V

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

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. Solid State Electronic Devices: Ben G Streetman, Sanjay Kumar Banerjee, Sixth Edition, PHI.

Syllabus for Semester II,

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE05PR0201

Course: Electronic Devices and Circuits Lab

L: 0 Hrs, P: 2 Hrs. Per week

Total Credits: 01

Course outcomes

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

1. Plot V-I characteristics of electronic components and verify parameters.
 2. Estimate the frequency response of multistage amplifier.
 3. Investigate Characteristics of power electronic devices.
 4. Analyze the feedback topologies for amplifier configuration.
 5. Analyze electronic circuits using EDA tool.
-

Experiments based on:

- Circuit Simulations using EDA tool
- Characteristics of transistors
- Biasing of Transistor
- Characteristics of Power Devices
- Single Stage and Two stage RC coupled amplifier using BJT
- Oscillator
- Feedback Amplifier

Syllabus for Semester II

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE05TH0202

Course: Network Theory

L: 3 Hrs, 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 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.
-

Module 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.

Module 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.

Module 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.

Module 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.

Module 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., Shyammmohan, 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 & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE05PR0203

Course: Electronics and Computer Workshop

L: 0 Hrs, 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.

Module-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.

Module-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 & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE05TH0204

Course: Object Oriented Programming and Data Structures

L: 3Hrs, P: 0Hr, Per Week

Total Credits: 3

Course Outcomes

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

1. Understand principles of object-oriented programming; create classes, instantiate objects and invoke methods.
 2. Understand object oriented features like Abstraction, Encapsulation, Inheritance and Polymorphism.
 3. Understand basic data structure and algorithms
 4. Understand implementation and application of various data structures such as stacks, queues and Linked List.
-

Module I:

Procedural Language vs Object Oriented Language, Features of Java, basic data types and Operators in Java, Control Statements, Access Specifiers, arrays in Java, Naming Conventions, Creating and importing packages.

Module II:

Class, Member functions, Constructors, static members, instantiating a class, constructor and method overloading, Object as a variable, object as an argument, object arrays.

Module III:

Abstraction, Encapsulation, Inheritance and Polymorphism. Inheritance: methods of derivation, super and final keyword, run time polymorphism, abstract class, interface, implementation of interface.

Module IV:

Elementary data organization, Algorithm, Time and Space Complexity, Asymptotic notations: Big-Oh Notation, Abstract Data Types (ADT), Arrays: Definition, Single & Multidimensional arrays and their complexity.

Module V:

Primitive Stack operations: Push & Pop, Prefix and Postfix Expressions evaluation using stack. Concept of Queue, Operations on Queue: Insert, Add, Delete, Full and Empty, Circular Queue, Doubly Ended Queue.

Module VI:

Singly Linked Lists: representation in memory, algorithms of several operations: traversing, searching, insertion, deletion, reversal, ordering, etc. time and space complexity of these operations.

Doubly Linked Lists: operations and algorithmic analysis

Text Books:

1. Programming with Java, E. Balaguruswamy, Tata McGraw Hill publication.
2. Data Structures Schaum's Outlines: Seymour Lipschutz, Tata McGraw Hill publication

Reference Books:

1. Herbert Schildt; JAVA The Complete Reference; Ninth Edition, Tata McGraw- Hill Publishing Company Limited.
2. D. Samanta; Classic Data Structure; PHI Publications; 2004

Syllabus for Semester II

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE05PR0204

Course: Object Oriented Programming and Data Structures Lab.

L: 0 Hrs, P: 2 Hr Per Week

Total Credits: 1

Course Outcomes

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

1. Apply principles of object-oriented programming; create classes, instantiate objects and invoke methods.
 2. Implement object oriented features like Encapsulation, Inheritance and Polymorphism.
 3. Implement data structures such as stacks, queues and Linked List and apply them to solve common computer science problems.
-

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 & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24HS01TH0202

Course: Environmental Science

L: 1 Hrs, P: 0 HrPer Week

Total Credits: 1

Unit 1: Sustainability Engineering

Multidisciplinary nature of Environmental Science, air and water pollution; solid waste management; local and global environmental challenges; climate change; sustainable cities; sustainable sources of energy, Introduction to the idea of sustainability and its relevance; environment-related legislation; Green Chemistry

Unit 2: E-Waste and Green Computing

E-waste Management: Sources, Legislation, Prevention, Control, Recent developments.

Waste due to Nano-materials and Micro-Plastics.

Green Computing: Green Computing, Computing in Environment and Research, Green devices and Green data Servers.

Text Books:

1. Shikha Agrawal, Engineering Chemistry: Fundamentals and Applications, Cambridge University Press.
2. Dr. Rajshree Khare, A Textbook of Engineering Chemistry (AICTE), S.K. Kataria & amp; Sons.
3. S. S. Dara, A Textbook of Engineering Chemistry, S. Chand Publications.
4. M Afshar Alam, Sapna Jain, Hena Parveen, Green Computing Approach Towards Sustainable Development, Wiley Interscience Publications.

Reference Books:

1. E-waste recycling and management: present scenarios and environmental issues, Khan, Anish, and Abdullah M. Asiri. 2019, Springer, Vol. 33. ISBN: 978-3-030-14186-8.
2. Hans-Eckhardt Schaefer, Nanoscience: The Science of the Small in Physics, Engineering, Chemistry, Biology and Medicine, Springer-Verlag Berlin Heidelberg.

Syllabus for Semester II

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24HS01PR0202

Course: Environmental Science Lab.

L: 0 Hrs, P: 2 Hr Per Week

Total Credits: 1

The students will learn to:

1. Apply the fundamental principles of measurement and skills in preparation and handling of Environmentally hazardous materials and interpret the statistical data related to measurements.
2. Use of the computational tools for searching, interpretation of results, etc. and preparation of case study regarding Environmental Issues.

List of Experiments:

Any Eight Experiments from the following:

- 1) Demonstration of Handling of hazardous chemicals, MSDS (material safety data sheet), waste minimization strategies and chemical waste disposal.
- 2) Preparation of different Solutions: Molar solution, Normal solution and percent solution and Determination of concentration in their various forms.
- 3) Basic statistical analysis of results of neutralization of acid against the base and preparing acceptable graphs using software.
- 4) Estimation of Copper ions from acid digested PCB solution.
- 5) Estimation of free CO₂ present in the given sample.
- 6) Estimation of Dissolved Oxygen present in the given water sample
- 7) Prediction of NMR spectra and analytical data of molecules using Computational Software and its analysis.
- 8) Spectroscopic determine of wavelength of maximum absorption of chemical/biological compound in solution and plotting of calibration curves.
- 9) Estimation of Fe (II) ions from e-waste rust spectrophotometrically / calorimetrically using 1, 10-Phenanthroline method.
- 10) Determination of Air quality index (AQI).
- 11) Determination of rate of the reaction at room temperature and analysis of experimental data using Computational Software
- 12) Use of various open online search tools for Environmental Case Studies.

Text Books

1. S. S. Dara, A Textbook on Experiments and Calculations in Engineering Chemistry, S. Chand Publications.
2. J. B. Yadav, Advanced Practical Physical Chemistry, Krishna's Prakashan Media (P) Limited.
3. A. J. Elias, Collection of Interesting General Chemistry Experiments, Universities Press Publications.
4. V. K. Ahluwalia, S. Dhingra and A. Gulati, College Practical Chemistry, Universities Press Publications.

Reference Books:

1. David Young, Computational Chemistry: A Practical Guide for Applying Techniques to Real World Problems, Wiley Interscience Publications

Syllabus for Semester II

B. Tech. Electronics & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24HS02TH0203 Course: Foundational Literature of Indian Civilization

L: 1 Hrs, P: 0 Hrs. Per week

Total Credits: 01

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:

Module 1:

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

Module 2:

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

Module 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

Module 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, VinayakRajatBhar, NagendraPavana 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 & Communication Engineering [School of Electrical and Electronics Engineering]

Course Code: 24HS04PR0201

Course: Sports-Yoga-Recreation Lab

L: 0Hrs, P: 2Hrs. Per week

Total Credits: 01

Aim of the Course: The course aims to foster Health and wellness through Healthy and Active Lifestyle and creating awareness about the fundamentals of Physical Education, Sports, Yoga, Recreation and its effectiveness through practical experiences and hands on activities.

Objectives of the Course:

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:

Module – 1:

- Warm up and Cool Down and Stretching Exercises.
- General and Specific Exercises.
- Calculation of BMI & Resting Pulse Rate.
- General and Specific exercises for strength, Speed, Agility, Cardiovascular Endurance, Flexibility, Coordinative abilities.
- Practice of Fundamental Skills of Volleyball, Table Tennis and Chess, etc.
- Knowledge and practice of the Equipment used in a Gymnasium and its application.

Module – 2:

- Yoga: Standing, Sitting, Prone & Supine positions.
- Suryanamaskar.
- Pranayama, Meditation and Relaxation Techniques.
- Recreational Games.
- Practice of Fundamental Skills of Basketball, Football, Carrom, etc.
- Health related Physical Fitness Test.

Assessment Pattern:

Assessment Type	Weightage in Marks	Total Marks
Practical	Physical Efficiency Test – 30 Marks Sports/Games skill Activity/Project – 10 Marks Yoga Activities – 10 Marks	50
	Total – 50 Marks	

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)

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hou rs/ wee k	Credi ts	Maximum Marks (Continuous Evaluation)
24HS02PR0206-01	Fundamentals of Indian Classical Dance: Bharatnatayam	I/II	2	1	50

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

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 *Pratham*(1st level formal exam of Bharatnatayam).

Syllabus

Practical -1: Orientation in Bharatnatayam

Practical-2: TattuAdavu till 8, NaattaAdavu 4 Steps, PakkaAdavu 1 step, MettaAdavu 1 Step, KudittaMettaAdavu 4 Steps,

Practical -3: Practice sessions

Practical-4: TattaKudittaAdavu (Metta), TattaKudittaAdavu (Metta) 2 Steps, TirmanamAdavu 3 Steps, KattuAdav - 3 Steps, KattuAdav - 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*, AdyaRangacharya, 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*, EshwarJayalakshmi, 2011

Syllabus for Semester II

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Se m.	Hou rs/ wee k	Credi ts	Maximum Marks (Continuous Evaluation)
24HS02PR0206-02	Fundamentals of Indian Classical Dance: Kathak	I/II	2	1	50

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), MaramiMedhi&DebasishTalukdar, 2022, Anshika Publication (13 September 2022)

Syllabus for Semester II

[School of Electrical and Electronics Engineering]Engineering]

Course Code	Course Name	Se m.	Hou rs/ wee k	Credi ts	Maximum Marks (Continuous Evaluation)
24HS02PR0206-03	Introduction to Digital Photography	I/II	2	1	50

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 II

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Se m.	Hou rs/ wee k	Credi ts	Maximum Marks (Continuous Evaluation)
24HS02PR0206-04	Introduction to Basic Japanese Language	I/II	2	1	50

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 AmeyaPatki, Daiichi Japanese Language Solutions (ISBN: 9788194562900)

Syllabus for Semester II

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Se m.	Hou rs/ wee k	Credi ts	Maximum Marks (Continuous Evaluation)
24HS02PR0206-05	Art of Theatre	I/II	2	1	50

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 Handbook for the Actor* (1st ed.). Vinatge Books New York.

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0206-06	Introduction to French Language	I/II	2	1	50

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 II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0206-07	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 II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Se m.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0206-08	Art of Painting	I/II	2	1	50

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 II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Se m.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0206-09	Art of Drawing	I/II	2	1	50

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 drawing
Practical 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 II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0206-10	Nature camp	II	2	1	50

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, other wildlife 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 II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0206-11	Developing Self Awareness	II	2	1	50

Course objectives:

The course aims to develop students in their personal as well as professional life by means of graphotherapy, NLP, and Neurobics

Course Outcomes:

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

CO1: Gain foundational understanding of graphology and through self-analysis will achieve greater awareness about their strengths and weaknesses & areas for personal growth

CO2: students will be equipped with tools and techniques for continuous self-improvement, using signature analysis and graphotherapy as part of their personal development journey

CO3: understand how to use Neuro Linguistic Programming (NLP) strategies to set and achieve goals effectively, overcoming mental blocks and limiting beliefs.

CO4: Enhance ability to absorb, retain, and recall information, which can benefit academic and professional performance.

Syllabus:

Practical 1: The Power of Handwriting (Handwriting is Brainwriting)

Practical 2: Know yourself through handwriting

Practical 3: The Role of Signature in your life

Practical 4: Graphotherapy to enhance yourself in all ways

Practical 5: Neurolinguistic Programming , S.M.A.R.T Goal

Practical 6: Effective Communication Model, Rapport Building and Anchor

Practical 7: Brain Directives & Linguistic Presuppositions

Practical 8: Neurobics

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0206-12	Art of Poetry	II	2	1	50

Course objectives:

To familiarize the students with the art of poetry and develop a sense of appreciation for the art

Course Outcomes:

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

CO1: Understand the origin and development of poetry

CO2: Appreciate the art of poetry in life

CO3: Develop aesthetic sense

CO4: Develop holistic perspective to their personality

Syllabus

Practical 1: Art of poetry – orientation

Practical 2: Forms of poetry – orientation

Practical 3: Forms of poetry – recitation

Practical 4: Application of poetry – orientation

Practical 5: Application of poetry – practical session

Practical 6: Poetry and aesthetics

Practical 7: Writing poetry – orientation

Practical 8: Writing poetry – writing sessions

Reading material

I. The Art of Poetry

1. Fry, S. (2005). The ode less travelled: Unlocking the poetic mind. HarperCollins.
2. Addonizio, K., & Laux, D. (1997). The poet's companion: A guide to the pleasures of writing poetry. W.W. Norton & Company.
3. Lucy, J. (Ed.). (2001). The art of poetry. Penguin Books.

II. Understanding and Interpretation of Poetry

1. Hirsch, E. (1999). How to read a poem: And fall in love with poetry. Harcourt Brace & Company.
2. Pinsky, R. (1998). The sounds of poetry: A brief history. Farrar, Straus and Giroux.
3. Meyer, M. (2005). Poetry: An introduction. Bedford/St. Martin's.

III. Writing Poetry

1. Hugo, R. (1979). The triggering town: Lectures and essays on poetry and writing. W.W. Norton & Company.
2. Bradbury, R. (1990). Zen in the art of writing: Releasing the creative genius within you. Bantam Books.
3. Behn, R., & Twichell, C. (Eds.). (1992). The practice of poetry: Writing exercises from poets who teach. HarperCollins.

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0206-13	Creative and Content Writing	II	2	1	50

Course objective:

The objective of the course is to equip students with comprehensive skills in creative and content writing through experiential learning and real-world applications.

Course outcomes:

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

CO1: Understand and apply fundamental concepts and techniques of creative writing.

CO2: Apply storytelling techniques to create engaging narratives.

CO3: Develop and implement effective SEO and digital content strategies

CO4: Create and refine content using various tools and applying diverse writing styles and formats.

CO5: Utilize digital tools to craft multimedia narratives and create a professional portfolio.

Syllabus

Creative Writing

Practical 1: **Introduction to Creative and Content Writing**

Practical 2: **Character and Story Development**

Practical 3: **Crafting Compelling Narratives**

Content Writing

Practical 4: **SEO and Digital Content Strategies**

Practical 5: **Writing for Media**

Practical 6: **Tools**

Content Creation

Practical 7: **Digital Storytelling**

Practical 8: **Creative Portfolio Launch**

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0206-14	Science of Life through Bhagwad Gita	II	2	1	50

Course Objective

The objective of the course is to seek directions from the Bhagwad Gita to garner life skills for a successful and happy life

Course Outcome

CO1: To understand the methodology to correctly interpret and analysis the scripture

CO2: To understand the application of various teaching of the Bhagwad Gita

CO3: Use meditation and breathing techniques for healthy mind and body.

Syllabus

Practical 1: **Introduction to Bhagwad Gita - methodology**

Practical 2: **Real life application of chapter 1-3**

Practical 3: **Real life application of chapter 4-6**

Practical 4: **Real life application of chapter 7-9**

Practical 5: **Real life application of chapter 10-12**

Practical 6: **Real life application of chapter 13-15**

Practical 7: **Real life application of chapter 16-18**

Practical 8: **Meditation and breathing techniques**

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0206-15	Sanskrit Sambhashan – Spoken Sanskrit	II	2	1	50

Course objectives:

The objective of the course is to enhance the communication skills of the students in Sanskrit

Course outcome

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

- CO1: Enhanced writing skills in Sanskrit
- CO2: Enhanced speaking skills in Sanskrit
- CO3: Enhanced listening skills in Sanskrit
- CO4: Enhanced writing skills in Sanskrit

Syllabus:

संस्कृतसम्भाषणशिविरस्य पाठ्यक्रमः

प्रथम दिनम्	द्वितीय दिनम्
❖ गीतम् - पठत संस्कृतम्..... । ❖ मम नाम -भवतः नाम किम्? भवत्याः नाम किम्? द्वयोः मध्ये परिचयः । परस्परं 5 जनान् । ❖ सः कः? सा का? तत् किम्? ❖ एषः, एषा, एतत् । ❖ अहम्, भवान्, भवती..... अभिनयः । ❖ आम्, न, वा/किम्..... अभिनयः । ❖ अस्ति × नास्ति..... अभिनयः । ❖ अत्र, तत्र, कुत्र, सर्वत्र, अन्यत्र, एकत्र - अभिनयः । ❖ षष्ठी - तस्य, एतस्य, कस्य, तस्याः, एतस्याः, कस्याः, मम, भवतः, भवत्याः..... अभिनयः । मम नासिका, भवतः नासिका, भवत्याः नासिका । एतत् कस्य? अङ्गानि प्रदर्श्य प्रश्नः । ❖ दशरथस्य..., सीतायाः..., लेखन्याः..., पुस्तकस्य..., । स्फोरकपत्रस्य (Flash Card) उपयोगः करणीयः । 'पुत्रः' 'पतिः' इत्यादीनां वाक्यपत्राणाम् (Charts) उपयोगः करणीयः । ❖ गीतम् - मनसा सततं स्मरणीयम् । ❖ आवश्यकम्, मास्तु, पर्याप्तम्, धन्यवादः, स्वागतम् । ❖ पूर्वनिश्चितसम्भाषणप्रदर्शनम् । ❖ क्रियापदानां पाठनम् - गच्छति । आगच्छति । पठति । लिखति । खादति । पिबति । क्रीडति । वदति । उत्तिष्ठति । उपविशति । ❖ गच्छामि । आगच्छामि..... । ❖ गच्छतु । आगच्छतु..... । ❖ सङ्ख्याः - (अ) 1, 2, 3, 4,.....10 । (आ) 10, 20, 30,.....100 । ❖ समयः - 5.00, 5.15, 5.30, 4.45 । ❖ कथा - गतानुगतिको लोकः । (काचित् कथा सरलया भाषया वक्तव्या) । ❖ रटनाभ्यासः (पूर्वमेव लिखितानि पठितानि च कानिचित् वाक्यानि वाचनीयानि) । ❖ एकं वाक्यम् (प्रत्येकं छात्रः एकं वाक्यं वदेत् ।) ❖ सूचना । ❖ ऐक्यमन्त्रः ।	❖ गीतम् । ❖ पुनस्स्मरणम् । ❖ शब्देषु लिङ्गभेदज्ञापनम् - यथा -सः सुधाखण्डः, सा कुञ्जिका, तत् पुष्पम् । ❖ बहुवचनपाठनम् - बालकाः..., बालिकाः..., लेखन्यः..., पुस्तकानि... । ❖ ते, के, ताः, काः, तानि, कानि, एते, एताः, एतानि, भवन्तः, भवत्यः, वयम् । (चित्राणि उपयोक्तव्यानि ।) ❖ वचनपरिवर्तनाभ्यासः । यथा - सः बालकः - ते बालकाः । ❖ अस्ति - सन्ति । ❖ कति? ❖ सप्तमी - हस्ते । उत्पीठिकायाम् । लेखन्याम् । पुस्तके । (स्फोरकपत्रस्य प्रयोगः करणीयः ।) ❖ वाक्यपत्रस्य उपयोगेन वाक्यानि वाचनीयानि । ❖ कदा? ❖ उत्तराणां प्रश्नाः । (शिक्षकः आरम्भे उत्तरं वदेत्, अनन्तरं छात्राः तस्य प्रश्नं पृच्छेयुः ।) ❖ यथा - रामः प्रातःकाले शालां गच्छति । रामः कदा शालां गच्छति? ❖ अद्य, श्वः, परश्वः, प्रपरश्वः, ह्यः, परह्यः, प्रपरह्यः, इदानीम् । ❖ गीतम् । ❖ गच्छन्ति । गच्छामः । गच्छन्तु । ❖ शिष्टाचारः - सुप्रभातम्/नमस्कारः/शुभरात्रिः/हरिः ओम्/क्षम्यताम्/चिन्ता मास्तु । ❖ प्रातर्विधिः - दन्तधावनम् इत्यादयः शब्दाः पाठनीयाः । ❖ सङ्ख्या - 1-50 । ❖ समयः - 6.05, 6.10, 5.55, 5.50 ❖ स्वागतसम्भाषणम् । (शिक्षकः सहशिक्षकेण सह कृत्वा प्रदर्शयेत्) ❖ कथा । ❖ रटनाभ्यासः । ❖ वाक्यद्वयम् (प्रत्येकम् अपि छात्रः वाक्यद्वयं वदेत् ।) ❖ सूचनाः । ❖ ऐक्यमन्त्रः ।
तृतीय दिनम्	

- ❖ गीतम् ।
- ❖ पुनस्स्मरणम् ।
- ❖ क्रियापदानां बहुवचनरूपाणि ।
गच्छन्ति - गच्छामः - गच्छन्तु (Chart दर्शनीयम्)
पिबन्ति - पिबामः - पिबन्तु ।
लिखन्ति - लिखामः - लिखन्तु ।
इत्यादिपरिवर्तनाभ्यासः कारणीयः ।
- ❖ द्वितीयाविभक्तिः - स्फोरकपत्राणाम् उपयोगः ।
(वाक्यपत्राणि उपयुज्य वाक्यानि वाचनीयानि ।)
- ❖ कृपया ददातु - वस्तूनि प्रदर्श्य ।
शिक्षकः एकैकं वस्तु प्रदर्शयति ।
उदा. - ग्रन्थः, घटी,.....
छात्राः - कृपया ग्रन्थं ददातु, कृपया घटीं ददातु इत्यादि
वदेयुः । (स्फोरकपत्रस्य उपयोगः)
- ❖ पुरतः, पृष्ठतः, वामतः, दक्षिणतः, उपरि, अधः ।
(चित्रं दर्शनीयम्)
- ❖ इतः, ततः,तः, गृहतः, कुतः?
(स्फोरकपत्राणाम् उपयोगः)
वाक्यपत्राणि उपयुज्य वाक्यानि वाचनीयानि ।
- ❖ गीतम् ।
- ❖ कथम्? सम्यक् ।
- ❖ शीघ्रम् × मन्दम् । उच्चैः × शनैः ।
- ❖ पठनार्थम्, किमर्थम्?
- ❖ सप्तककाराः - किम्, कुत्र, कति, कदा, कुतः, कथम्,
किमर्थम् (Chart प्रदर्शनीयम्) ।
एकैकम् उपयुज्य परस्परं प्रश्नाः ।
- ❖ अपि ।
- ❖ अस्तु ।
- ❖ अहं न जानामि । - कानिचन वाक्यानि ।
- ❖ भूतकालीनक्रियापदानां पाठनम् ।
गतवान् - पठितवान् - लिखितवान् ।
गतवती - पठितवती - लिखितवती ।
- ❖ क्रियापदकोष्ठकस्य प्रथमपृष्ठस्य अभ्यासः ।
- ❖ द्वितीयपृष्ठस्य सर्वाणि क्रियापदानि उपयुज्य छात्राः
वर्तमानकाले वाक्यानि वदन्ति । (ए.व - ब.व.)
- ❖ विशिष्टक्रियापदानाम् अभ्यासः -
करोमि - कुर्मः । करोति - कुर्वन्ति ।
ददामि - दद्वः । ददाति - ददति ।

शृणोमि - शृणुमः । शृणोति - शृण्वन्ति ।

जानामि - जानीमः । जानाति - जानन्ति ।

- ❖ सम्बोधनम् - भोः !, श्रीमन् !, मान्ये !, भगिनि!, मित्र !,
.....महोदय!, राम !, सीते ! इत्यादि ।
- ❖ सङ्ख्या- 1-100 ।
- ❖ समयः - 1.00, 2.00, 3.00, 4.00 ।
- ❖ सम्भाषणप्रदर्शनम् (मित्रसंलापः) ।
- ❖ कथा ।
- ❖ वाक्यत्रयम् एकैकोऽपि छात्रः वदेत् ।
- ❖ सूचना ।
- ❖ ऐक्यमन्त्रः ।

चतुर्थं दिनम्

- ❖ गीतम् ।
- ❖ पुनःस्मरणम् ।
- ❖ च
- ❖ अतः
- ❖ एव
- ❖ इति
- ❖ अस्मि
- ❖ यदि -तर्हि
- ❖ यथा - तथा
- ❖ तः - पर्यन्तम् (वाक्यपत्रस्य उपयोगेन वाक्यानि
वाचनीयानि ।)
- ❖ अद्य आरभ्य
- ❖ कृते (वाक्यपत्रस्य उपयोगः करणीयः)
- ❖ क्तवतुप्रत्ययान्तानाम् अभ्यासः
गतवान् - पठितवान् - लिखितवान् (ए.व. पुलिङ्गे) ।
गतवती - पठितवती - लिखितवती (ए.व. स्त्रीलिङ्गे) ।
गतवन्तः - पठितवन्तः - लिखितवन्तः (ब.व. पुलिङ्गे) ।
गतवत्यः - पठितवत्यः - लिखितवत्यः (ब.व. स्त्रीलिङ्गे) ।
- ❖ सः गतवान् - सा गतवती - लिङ्गपरिवर्तनाभ्यासः ।
- ❖ अहं गतवान् - अहं गतवती - लिङ्गपरिवर्तनाभ्यासः ।
- ❖ क्रियापदानां कालपरिवर्तनाभ्यासः ।
यथा - गच्छति - गतवान्, गतवती ।
- ❖ गीतम् ।
- ❖ विशेषपाठनम् - आसीत्, आसन्, आसम् ।
- ❖ एकः, एका, एकम् - लिङ्गभेदः ज्ञापनीयः ।
(स्फोरकपत्रस्य उपयोगः)

- ❖ भोजनसम्बन्धिशब्दाः यथा - सूपः, शाकम्, इत्यदयः ।
- ❖ सङ्ख्या ।
- ❖ समयः ।
- ❖ ॐ - सङ्ख्याक्रीडा ।
- ❖ कथा ।
- ❖ सम्भाषणप्रदर्शनम् ।
- ❖ चत्वारि वाक्यानि ।
- ❖ सूचना ।
- ❖ ऐक्यमन्त्रः ।

पञ्चमं दिनम्

- ❖ गीतम् ।
- ❖ पुनःस्मरणम् ।
- ❖ वाहनानां नामानि ।
- ❖ तृतीयाविभक्तिः - दण्डेन, मापिकया, लेखन्या, पुष्पेण ।
(वाक्यपत्रस्य आधारेण वाक्यानि वाचनीयानि ।)
- ❖ सह, विना ।
- ❖ अद्यतन, ह्यस्तन, धस्तन, पूर्वतन, इदानीन्तन
- ❖ भविष्यत्कालीनक्रियापदानां पाठनम् ।
गमिष्यति, पठिष्यति, लेखिष्यति ।(कोष्टकस्य साहाय्येन)
- ❖ गत, आगामि ।
- ❖ गीतम् ।
- ❖ स्म ।
- ❖ अभवत् ।
- ❖ क्त्वाप्रयोगः (कोष्टकस्य साहाय्येन) ।
- ❖ यदा - तदा ।
- ❖ बन्धुवाचकशब्दाः ।
- ❖ वेशभूषणानां नामानि ।
- ❖ वर्णाः ।
- ❖ रुचयः ।
- ❖ क्रीडा - एकधासेन सङ्ख्याकथनम् ।
- ❖ कथा ।
- ❖ पञ्च वाक्यानि ।
- ❖ सूचना ।
- ❖ ऐक्यमन्त्रः ।

षष्ठं दिनम्

- ❖ गीतम् ।
- ❖ पुनःस्मरणम् ।
- ❖ नूतनम् x पुरातनम्,

- ❖ बहु x किञ्चित्,
- ❖ दीर्घः x ह्रस्वः ।
- ❖ उन्नतः x बामनः ।
- ❖ स्थूलः x कृशः ।
- ❖ एतादृश, तादृश, कीदृश?
- ❖ तुमुन् (कोष्टकस्य साहाय्येन) ।
- ❖ किन्तु ।
- ❖ निश्चयेन ।
- ❖ बहुशः / प्रायशः ।
- ❖ किल / खलु ।
- ❖ शक्नोति ।
- ❖ गीतम् ।
- ❖ विशेषणविशेष्यभावस्य अभ्यासः ।(प्रथमाविभक्तौ)
सः उत्तमः बालकः ।
सा उत्तमा बालिका ।
तत् उत्तमे पुस्तकम् ।
- ❖ इव । विनोदकणिका ।(गतवान् 'इव' अभिनये कृतवान्!)
- ❖ अपेक्षया ।
- ❖ पशूनां नामानि ।
- ❖ अवयवानां नामानि ।
- ❖ वाक्यविस्तारणाभ्यासः ।
(सः मम पुस्तकं प्रातःकाले पञ्चवादने पठितवान् ।)
- ❖ इतः पूर्वम् - इतः परम् ।
- ❖ 'रामकृष्ण' सङ्ख्याक्रीडा ।
- ❖ कथा ।
- ❖ षट् वाक्यानि ।
- ❖ सूचना ।
- ❖ ऐक्यमन्त्रः ।

सप्तमं दिनम्

- ❖ गीतम् ।
- ❖ पुनःस्मरणम् ।
- ❖ क्त्वा - तुमुन् - परिवर्तनाभ्यासः ।
- ❖ बहिः x अन्तः ।
- ❖ रिक्तम् x पूर्णम् ।
- ❖ इतोऽपि ।
- ❖ इत्युक्ते ।
- ❖ अन्ते ।
- ❖ चेत् - नो चेत् ।

- ❖ गीतम् ।
- ❖ आरोग्यसम्बन्धिशब्दाः – वैद्यरोगिसम्भाषणम् ।
- ❖ प्रश्नोत्तरस्पर्धा ।
- ❖ ऋषीणां नामानि ।
- ❖ कथा - शिक्षकः एकां कथां वदति । अनन्तरं छात्रेषु एकैकः तस्याः कथायाः एकैकं वाक्यम् उक्त्वा कथां सम्पूर्णां करोति ।
- ❖ सङ्ख्या - दीर्घसङ्ख्यापाठनम् ।
- ❖ प्रश्नोत्तरम् ।
- ❖ क्रीडा - (गणद्वये नामस्मरणक्रीडा)
- ❖ कथा ।
- ❖ पुस्तकानां परिचयः ।
- ❖ सप्त वाक्यानि ।
- ❖ सूचना ।
- ❖ ऐक्यमन्त्रः ।

अष्टमं दिनम्

- ❖ गीतम् ।
- ❖ पुनःस्मरणम् ।
- ❖ वारम् ।
- ❖ अतः - यतः परिवर्तनाभ्यासः ।
- ❖ यद्यपि - तथापि ।
- ❖ यत्र - तत्र ।
- ❖ कति - कियत् - एतयोः भेदज्ञापनम् ।
- ❖ यावत् - तावत् ।
- ❖ यत् - तत् ।
- ❖ यः - सः ।
- ❖ या - सा ।
- ❖ गीतम् ।
- ❖ अस्माकम् ।
- ❖ चर्चा ।
- ❖ सङ्ख्या - 'शतायुः - गतायुः' क्रीडा ।
- ❖ विनोदकणिकाकथनम् ।
- ❖ कथा ।
- ❖ अष्ट वाक्यानि ।
- ❖ समाजनिधिविषये सूचना ।
- ❖ ऐक्यमन्त्रः ।

नवमं दिनम्

- ❖ गीतम् ।
- ❖ पुनःस्मरणम् ।
- ❖ चित् ।
- ❖द्वयम् ।
- ❖ सङ्ख्यासु लिङ्गभेदः ।
एकः - एका - एकम्
द्वयम् - द्वयम् - द्वयम्
त्रयः - तिस्रः - त्रीणि
चत्वारः - चतस्रः - चत्वारि
- ❖ शिक्षकः - अहं वैद्यः - मम नाम सुरेशः
(छात्राः तमुद्दिश्य प्रश्नान् पृच्छेयुः ।)
- ❖ अर्थम् (समाजार्थम्, संस्कृतकार्यार्थम्...) ।
- ❖ गीतम् ।
- ❖ तव्यत् - अनीयर् ।
- ❖ अनन्त्यकथारचना ।
- ❖ सङ्ख्यान्वेषणम् (क्रीडा) ।
- ❖ छात्रैः सह प्रश्नोत्तरम् ।
- ❖ समाजनिधिविषये पुनःस्मरणम् ।
- ❖ ऐक्यमन्त्रः ।

दशमं दिनम्

- ❖ गीतम् ।
- ❖ पुनःस्मरणम् ।
- ❖ पत्रलेखनम् ।
- ❖ दूरवाणीसम्भाषणम् ।
- ❖ मार्गनिर्देशः - कुत्र गन्तव्यम् इत्यादि ।
- ❖ तव्यत् अभ्यासार्थम् - अद्य किं किं करणीयम् ?
- ❖ सान्दर्भिकभाषणम् -
1. प्रवासात् प्रतिनिवर्तनस्य ।
2. आपणिकस्य इत्यादि ।
- ❖ क्रीडा - सङ्ख्यायोजनम् (गणद्वये) ।
- ❖ शुभाशयाः ।
- ❖ असत्यकथनम् / कल्पनाकथनम् ।
- ❖ समारोपः (सर्वैः शिक्षार्थिभिः भारतमातुः पूजां कृत्वा निधिसमर्पणं करणीयम् ।)
- ❖ पत्राचारप्रगतशिक्षणादिविषये सूचना ।
- ❖ ऐक्यमन्त्रः ।

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0206-16	Kirtan Kala	II	2	1	50

Course objectives:

The objective of the course is to provide the students with a spiritual experience as well as its benefits to them in the form of better abilities to concentrate and develop the ability to create a peaceful mind.

Course outcome

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

CO1: Learn from the inspiring spiritual journey of the saints and the history of Kirtan tradition

CO2: Learn about the musical instruments used in the art of Kirtan

CO3: Develop communication skills

- कीर्तन परंपरेचा इतिहास आणि अखिल भारतातील कीर्तन परंपरांचा परिचय
- चार महिन्यात वीस संतचरित्रांचा परिचय अधिक त्याविषयी प्रवचन
- वीस संतांचा वाङ्मयीन परिचय
- प्रमुख पाच कीर्तन पद्धतींचे मांडणी तंत्र.
- पूर्वरंग - उत्तररंग सहित कीर्तनप्रक्रियेतील सर्व महत्वाचे टप्पे.
- कीर्तनासाठी आवश्यक असणारी कंठ संगीतात्मक माहिती
- टळ, मृदंग, वीणा, तबला, पेटी या वाद्यांची ओळख.
- प्रवचनांसाठी अभ्यासग्रंथांचे मार्गदर्शन.
- वक्तृत्व कला, संभाषण कला, संवाद कौशल्य, कथाकथन यांची रहस्ये
- कीर्तनाचे अनुषंगाने संस्कृत मराठी श्लोक, सुभाषिते व प्रमाणाधार अशी ओव्या अभंगांची शिदोरी.

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS04PR0202 – 1	Adventure Sports	II	0	1	50

Course Objective:

This course introduces adventure sports, emphasizing experiential learning through participation in various activities. The course will cover the fundamentals, safety procedures, and physical and mental benefits of adventure sports. Students will engage in outdoor activities such as wall climbing, rappelling, and more, fostering a connection with nature and understanding the principles of risk management.

Course Outcome: By the end of this course, students will:

- Understand the principles and benefits of adventure sports.
- Develop basic skills in selected adventure sports.
- Learn and apply safety measures and risk management techniques.
- Foster teamwork, leadership, and problem-solving skills.
- Cultivate a greater appreciation for nature and outdoor activities.

Syllabus:

- Tent pitching, knot practice session and Tent allotment
- Activities like Jumaring and Climbing
- Individual challenge like Burma bridge, ladder bridge, multi vine
- Group Task like improvise raft making and Kayaking
- Activities like Archery rifle shooting, cycle ride

Pattern of Classes: 2 Days and 1 Night Camp.

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
24HS04PR0202 – 2	Introduction to Defense Forces & Obstacle Training	II	0	1	50

Course Objective:

- Understand the Structure and Function of Defense Forces
- Familiarize with Defense Force Training and Discipline
- Learn Basic Obstacle Course Techniques
- Apply Problem-Solving and Teamwork in Obstacle Training
- Explore the Role of Obstacle Training in Defense Preparedness

Course Outcome:

Upon successful completion of the course, students should be able to:

- Describe the Structure and Functions of Defense Forces
- Demonstrate Knowledge of Defense Training Protocols
- Navigate Basic Obstacle Courses
- Collaborate and Problem-Solve in Team-Based Exercises
- Connect Obstacle Training to Defense Preparedness
- Evaluate and Reflect on Training Experiences

Syllabus:

- Knot and Hitch practice session
- Activities like Rappelling & Wall Climbing
- Burma bridge & ladder bridge
- First Aid
- Rifle Shooting
- Horse riding
- Group Task and Team building activities

Pattern of Classes: 2 Days and 1 Night Camp.

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS04PR0202 – 3	Self Defense & Indian Martial Arts	II	0	1	50

Course Objective:

This course provides students with practical knowledge and skills in self-defense, focusing on personal safety and awareness. Students will learn basic techniques for self-defense, including striking, blocking, and evasion, while also discussing the legal and ethical considerations of self-defense. The course will emphasize both physical techniques and mental preparedness.

Course Outcome: By the end of this course, students will:

- Understand the principles of personal safety and awareness.
- Learn and practice basic self-defense techniques.
- Develop strategies to avoid dangerous situations.
- Understand the legal and ethical implications of using self-defense.
- Build confidence and physical fitness through regular practice.

Syllabus:

1. Mental Awareness

- Importance of Self Defense
- Types of Self Defense
- Rules of Self Defense

2. Physical Session

- Various Self Defense Techniques
- Different Situational Defense Techniques

3. Improvise Weapon

- Knowledge and practice of different equipment's which can be used for self defense

4. Martial Arts

- Introduction of Indian Martial Arts
- Demonstration of Indian Martial Arts
- Training of Indian Martial Arts (Lathi Kathi)

Pattern of Classes: 12 Classes in a Semester. Classes will be held once a week.

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS04PR0202 – 4	Basic Nutritional Course	II	0	1	50

Course Objective:

In the "Basics of Nutrition" course, students will develop a comprehensive understanding of essential nutrients and their roles in supporting overall health. They will learn to apply dietary guidelines effectively, tailoring recommendations to various age groups and health conditions. Additionally, students will cultivate the skills needed to assess and improve their own and others' eating habits for better health outcomes.

Course Outcome:

By the end of the course, students will be able to accurately describe the functions of key nutrients and their impact on health, create balanced meal plans based on established dietary guidelines, and critically evaluate nutrition information to distinguish between credible and misleading sources.

Syllabus:

Unit I

- Introduction to Nutrition – Define Balanced Diet, Nutrition, Optimum Nutrition, Nutrients, Concept of Health, Recommended Dietary Allowances (RDA)
- Carbohydrates (sources, functions and digestion)
- Proteins (sources, functions and digestion)
- Fats (sources, functions and digestion)
- Micronutrients (vitamins and minerals-sources, functions and digestion)

Practical I

- Display of all the foods with the help of students and while demonstrating teacher will again explain role and importance of nutrition in daily life. Deficiency will lead to chronic diseases and its prevention is very necessary for the quality of life.

Unit II

- What is Body Mass Index?
- What is Basal Metabolic Rate?
- What is Ideal Body Weight? (Male/Female)
- How to read labels on Food Packets?
- How to choose smart food and Concept of Rainbow diet, My Food Pyramid or My plate given by ICMR-NIN.

Practical II

- Calculation of Body Mass Index, Basal Metabolic Rate, Ideal Body Weight (Male/Female) with the use of self-body measurements.
- Demonstration of Rainbow diet, My Food Pyramid or My plate in a class.

Pattern of Classes:

Theory Classes – 10

Practical Classes – 2

Syllabus for Semester II

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS01PR0203	Remedies by Ayurveda	II	2	1	50

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 Bramhitel, BramhiAwala, 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 MukundSabnis, ChaukhambhaAmarbharatiPrakashan.
- 2) Everyday Ayurveda by ShaileshRathod
- 3) A text Book of Rasashastra by Vikas Dhole and Prakash Paranjpe
- 4) A text Book of BhajajyaKalpanaVijñana

Syllabus for Semester II,
[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS01PR0204	Biodegradation of Kitchen Waste	II	2	1	50

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 various states 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 their importance
- 6) Preparation of Indian sweets like Besankeladdu 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

- [2] Arora, K.,; Theory of cookery; First Edition, Frank Brothers Company (Pub) Pvt. Ltd., 2008 ISBN:9788184095036, 8184095031
- [3] Philip, Thangam . E.,; Modern Cookery: Vol. 1; Sixth Edition, Orient BlackSwan., 2008 ISBN:9788125040446, 8125040447ali
- [4] ParvinderS;Quantity Food Production Operations and Indian Cuisine (Oxford Higher Education); FirstEdition; Oxford University Press, 2011 ISBN 10: 0198068492 ISBN 13: 9780198068495
- [5] Singh, Yogesh; A Culinary Tour of India; First Edition I.K. International Publishing House Pvt. Ltd. ISBN 978-93-84588-48-9
- [6] Singh Shakesh;Simplifying Indian Cuisine;First Edition, Aman Publications, ISBN81-8204-054-X
- [7] Dubey Krishna Gopal; The Indian Cuisine;PHI Learning Pvt. Ltd.ISBN978-81 203-4170-8

Syllabus for Semester II,
[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
24HS05PR0205	Herbal Home Remedies: A Course for Self-Care	II	2	1	50

Course Objectives:

1. To identify and recognize common medicinal herbs and plants.
2. To understand the basics of herbalism and safety precautions.
3. To learn to prepare and use herbal remedies for common ailments.

Course outcome:

By the end of this course, students will be able to:

1. Confidently identify and use local herbs for health benefits
2. Increase their observational skills of natural objects
3. Prepare and apply herbal remedies for self-care
4. Integrate herbalism into daily routines for wellness

Outline of Syllabus

Module 1 - Learn about sustainable foraging and gardening practices.

Module 2 - Understand how to create a herbal home remedy kit

Module 3 - Develop self-care routines using herbal remedies.

Practical/visit based on above syllabus.

Extended Activities

Creating a Plant Collection, Awareness, Slogan, poem etc.

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24EE07PR0205	Day-to-Day Electrical Systems	II	2	1	50

Course Outcomes:

After completion of the course, students will be able to

CO1	Understand how to measure and interpret electrical parameters of home appliances & calculate residential bills.
CO2	Comprehend the concept of energy star ratings and their significance.
CO3	Gain practical knowledge of residential wiring techniques.
CO4	Identify and understand the components of a residential solar PV system.
CO5	Understand the importance of ELCB, MCB, and fuses in electrical safety
CO6	Conduct market surveys to evaluate different electric two-wheelers.

Syllabus

Identification of parameters of home appliances using the Power guard meter.

Calculation and verification of the residential energy bill.

Energy efficiencies of home appliances- Introduction to Star ratings: Case Study.

Implementation of simple wiring used in residential installations.

Identification of components of Solar Photovoltaic systems for residential consumers.

Understanding the necessity and application of Earth Leakage Circuit Breaker (ELCB) and Miniature Circuit Breaker (MCB) and Fuse.

Comparative study of Electric Two-Wheelers (Market Survey)

Hands-on training in Digital meters.

Text/ Referencebooks:

1	Electrical Measurement, Signal Processing, and Displays" by John G. Webster.
2	Electrical Installation Design Guide: Calculations for Electricians and Designers" by The Institution of Engineering and Technology.
2	Solar Photovoltaic Technology and Systems: <i>Chetan Singh Solanki, PHI learning Pvt. Ltd., 2014</i>
3	Modern Wiring Practice: Design and Installation" by W. E. Steward and R. A. Beck.
4	Electrical Safety Handbook" by John Cadick, Mary Capelli-Schellpfeffer, Dennis Neitzel, and Al Winfield.

SEMESTER – III

Course outcomes

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

1. Understand the fundamentals of Verilog.
2. Describe Test Bench for testing Verilog designs effectively.
3. Design Finite State Machines using Verilog.
4. Design combinational and sequential circuits using Verilog.
5. Implement digital functions using Programmable Logic Devices.

Unit I :

Introduction to Verilog, Fundamentals of Verilog including language basics and relation to circuit implementation, Modules and Ports in Verilog, Modeling techniques in Verilog, Verilog constructs and codes, Synthesis and Simulation.

Unit II :

Combinational Circuits Design in Verilog: Comparators, Multiplexers and De-multiplexer, Encoder, Decoder, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU.

Unit III –

Sequential Circuits Design in Verilog: Latches/buffers and Flip-Flops as memory storage elements, Counters, Shift registers, Memory and its internal organization.

Unit IV –

FSM design, Task and Functions, User Defined Primitive, Timing and delays, Test bench, Advanced concepts.

Unit V -

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

Text Books:

1. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, Prentice Hall; 2nd edition (21 February 2003)
2. Stephen Brown and Zvonko Vranesic, “Fundamentals of Digital Logic with Verilog Design” TataMcGrawHill, 3rd ed, 2009.

Reference Books:

1. W.H. Gothmann, “Digital Electronics- An introduction to theory and practice” , PHI, 2nd edition ,2006
2. M. Morris Mano and Michael Ciletti, “Digital Design: With an Introduction to Verilog HDL”, 5e, 2011
3. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 1989

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

Course Code: 24EE05PR0301

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. Implement digital 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: 24EE05TH0302

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:

Introduction to Differential amplifiers, Characteristics of an operational amplifier, 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, 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.

Unit IV:

Op-amp's non-Linear applications: Clipper, clamper, comparator, zero crossing detector, Schmitt trigger circuits, Triangular wave generator, 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, Introduction to PLL and its application, Integrated Circuit Voltage Regulators, Serdes– serializer and deserializer, Double Data Rate – DDR, GDDR, HBM

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: *Ramakant Gaikwad, 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: 24EE05PR0302

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 applications of 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: 24EE05TH0303

Course: Signals and 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 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.

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 MicrocomputerSystems, RealTime 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: 24EE05PR0304 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 LPC2148
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.

SEMESTER – IV

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

Course Code: 24EE05TH0401

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

Course: Electromagnetic Fields

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.

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, Stokes' Theorem.

Unit – IV

Time-Varying Fields and Maxwell's Equations: Displacement current and Displacement current Density, Continuity equation for Time varying Fields, Faraday's law, Maxwell's equations for steady fields, Maxwell's equations for time varying fields, 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: 24EE05TH0402

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:

Need for modulation, Amplitude Modulation, Linear modulation schemes, Angle Modulation, Frequency Modulation, Non linear effects in FM Systems, Superheterodyne receiver, Spectrum Analysis of AM and FM, Noise in amplitude modulation Systems, FM Stereo Multiplexing

Unit II

Sampling Process, Analog Pulse Modulation Methods, PCM, DPCM, DM and Adaptive DM, SNR in PCM and DM, FDM in Telephone System, Synchronization in TDM System, Data Multiplexers, Voice coder (Vocoders)

Unit III

Line Coding Review, Digital Data Transmission, Intersymbol Interference (ISI), Eye Diagrams for Binary and Quaternary Systems, Correlative Coding, Duobinary Encoding, Partial Response Signaling, Scramblers, Digital Receivers and Regenerative Repeaters

Unit IV

Digital Modulation Techniques: ASK, FSK, M-Ary FSK, MSK, Gaussian MSK, PSK, DPSK, QPSK, QAM, Probability of Error evaluations for ASK, FSK, PSK, Optimum Filter, Matched Filter, Signal Space Analysis of Optimum Detection, Multiuser Detection

Unit V

Spread Spectrum, Pseudo noise Sequences, Direct Sequence Spread Spectrum, Frequency hop Spread Spectrum, ML and Gold codes, Convolutional Codes, Decoding Methods of Convolutional Codes: Viterbi Algorithm, Sequential Decoding

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: 24EE05PR0402 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 Modulation
- FDM and TDM
- Communication Receiver
- Communication Software Study
- Digital Modulation Scheme

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

Course Code: 24EE05TH0403

Course: Computer Communication 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 IV, B. Tech. (Electronics and Communication Engineering)

Course Code: 24EE05PR0403 Course: Computer Communication 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 IV, B. Tech. (Electronics and Communication Engineering)

Course Code: 24EE05TH0404

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 IV, B. Tech. (Electronics and Communication Engineering)

Course Code: 24EE05PR0404

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:

- To find DFT, IDFT of given discrete signals.
- To find circular convolution by DFT-IDFT method.
- To find FFT of given discrete signals.
- Designing 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 IV, B. Tech. (Electronics and Communication Engineering)

Course Code: 24EE05PR0405

Course: Fundamentals of Linux 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 basic commands of linux operating system and can write shell scripts
2. Create file systems and directories and operate them
3. Create processes background and foreground etc.by fork () system calls
4. Create shared memory segments, pipes,message queues and can exercise interprocess communication

LIST OF EXPERIMENTS:

1. Study and Practice on various commands like man, passwd, tty, script, clear, date, cal, cp, mv, ln, rm, unlink, mkdir, rmdir, du, df, mount, umount, find, unmask, ulimit, ps, who, w.
2. Study and Practice on various commands like cat, tail, head, sort, nl, uniq, grep, egrep,fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, tar, cpio.
3. a) Write a Shell Program to print all .txt files and .c files.
b) Write a Shell program to move a set of files to a specified directory.
c) Write a Shell program to display all the users who are currently logged in after a
Specified time.
d) Write a Shell Program to wish the user based on the login time.
4. a) Simulate cat command.
b) Simulate cp command.
5. a) Simulate head command.
b) Simulate tail command.
6. a) Simulate mv command.
b) Simulate nl command.
7. Write a program to handle the signals like SIGINT, SIGQUIT, SIGFPE.
8. Implement the following IPC forms

- a) FIFO
 - b) PIPE
9. Implement message queue form of IPC.
10. Implement a shared memory form of IPC. Write a Socket program to print system date and time (Using TCP/IP).

V SEMESTER

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

Course Code: 24EE05TH0501

Course: Embedded Systems

L: 3 Hrs, T: 0 Hr, P: 2 Hrs. Per week

Total Credits: 04

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.

List of Experiments – Embedded Systems

Experiment No.	Aim	CO Mapped
01	Study debugger/IDE/Kit for STM microcontrollers	CO1,2
02	Understanding GPIO pins of STM32	CO3,4,5
03	Interfacing I/O device with STM32	CO3,4,5
04	Interfacing seven segment display with STM32	CO3,4,5
05	Interfacing LCD/OLED interfacing with STM32	CO3,4,5
06	Demonstrating communication protocol	CO3,4,5
07	Generating square wave using timers in STM32	CO3,4,5
08	Generating PWM signal using STM32	CO3,4,5
09	Interfacing DAC/ADC with STM32	CO3,4,5
10	Project	CO1,2,3,4,5

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

Course Code: 24EE05TH0404

Course: CMOS VLSI Design

L: 3 Hrs, T: 0 Hr, P: 2 Hrs. Per week

Total Credits: 04

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 Systems Perspective, 4th Edition, Pearson Education India, 2011.
2. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.

Reference Books:

1. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979
2. P. Douglas, VHDL: programming by example, McGraw Hill, 2013.
3. L. Glaser and 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.

List of Experiments–CMOS VLSI Design

1. Evaluate the output characteristics for 1 μ m (long channel) and 50nm (short channel) technology N-channel and P-channel MOSFET. What difference did you observe in long channel and short channel design? (CO1, CO3)
2. Plot the transfer characteristics of CMOS inverter (CO1, CO2, CO3)
3. Observe the effect of ratio β_n/β_p and temperature on the transfer characteristics of an inverter. (CO1, CO2)
4. Design the Layout of CMOS inverter for equal rise/fall times in 120nm technology. (CO4)
5. Sketch a 2-input NOR gate (in static CMOS) with transistor widths chosen to achieve equal rise and fall resistance as a unit inverter. (CO4)
6. Implement the equation $X = \overline{((AB + C)D)}$ using static CMOS logic. Size the devices so that the output resistance is the same as that of an inverter with an NMOS $\frac{W}{L} = 3$ and PMOS $\frac{W}{L} = 6$. Which input pattern(s) would give worst and best equivalent pull-up or pull-down resistance? (CO1, CO3)
7. Implement and simulate DominoXOR gate in 50nm CMOS technology. (CO1, CO3)
8. Implement D Flip Flop. Define and estimate setup time for your design through SPICE simulation. (CO1, CO5)

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

Course Code: 24EE05TH0503 Course: Probability Theory and Random 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 of Set 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 - Bernoulli'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: 24EE05PR0504

Course: System Design Workshop

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

Total Credits: 02

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 electronic industry.
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: 24EE05TH0505 – 1

Course: Control Systems

(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 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, Bode 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 V, B. Tech. (Electronics and Communication Engineering)

Course Code: 24EE05TH0505 – 2

Course: Data Structures and Algorithms

(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. Analyze the efficiency of algorithms by evaluating their time and space complexities.
2. Design solutions to problems using linear data structures, such as stacks and queues.
3. Implement real-life problems using arrays and linked lists with dynamic memory allocation.
4. Demonstrate nonlinear data structures and their operations, such as trees and graphs.
5. Apply different searching, sorting, and hashing techniques for efficient data organization and retrieval.

UNIT-I:

Data Structures and Applications:

Stack, Queue and Linked List Extensions: Applications of stacks, Recursion simulation using stacks, Backtracking applications, Memory management applications, Multiple stack implementation, Dynamic stack implementation

Priority Queue: Concept and applications, Implementation using arrays and linked structures, Priority queue operations and complexity analysis, Circular Queue applications, Double Ended Queue (Deque): Input restricted deque, Output restricted deque, Applications

Linked Lists, Header linked lists, Circular linked lists: Representation, Operations, Complexity analysis, Linked list applications: Polynomial representation, Sparse matrix representation, Dynamic memory management

UNIT-II:

Trees and Tree-Based Data Structures:

Trees: Terminologies, Binary tree, Representation of trees and operations, Binary search tree [BST] and operations, Threaded binary trees. Tree traversal techniques: Preorder, Inorder, Postorder

Self-balancing Search Trees: Tree rotations, AVL tree & operations, B tree, B+- tree and operations. B-Trees and External Storage Structures: Need for external data structures, B-Tree: Properties, Searching, Insertion, Deletion, Applications in databases and file systems

UNIT-III:

Graph Data Structures and Algorithms:

Introduction to Graphs: Basic terminologies, representation of graphs, graph traversals: depthfirst search (DFS) and Breadth first search (BFS).

Applications of Graph Traversal: Finding connected components, Path finding, Network analysis, Spanning Trees, Minimum Spanning Tree concept, Applications of spanning trees, Introduction to: Prim's algorithm, Kruskal's algorithm

UNIT-IV:

Sorting, Searching and Hashing:

Sorting: Internal and External sorting, Concept of Stable sort, Implementation of Shell, quick, merge, heap, counting sort, performance analysis and comparison.

Searching: Revision of linear search, binary search and complexity analysis of search methods.

Hash functions and hash tables, closed and open hashing, randomization methods (division method, mid-square method, folding), collision resolution techniques. Applications of Hashing, Symbol tables, Dictionary implementation, Database indexing concepts

UNIT-V:

Advanced Data Structures and Algorithmic Applications

Trie Data Structure: Introduction to Trie, Representation and operations: Insertion, Searching, Deletion, Applications: Dictionary search, Auto-complete systems, String processing

Disjoint Set Data Structure: Introduction to Union-Find structure, Operations: Make-set, Find, Union, Path compression, Union by rank, Applications: Connectivity problems, Graph algorithms

Data Structure Design Applications: Selecting appropriate data structures for problems, Comparing data structures based on: Time complexity, Space requirements, Application requirements

Textbooks:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed; Fundamentals of Data Structures in C; Second Edition; Universities Press; 2008.
2. Robert Kruse, C. L. Tondo, Bruce Leung, Sashu Mogalla, Data Structures and Program Design in C; Second Edition; Pearson Education; 2006.
3. Mark Allen Weiss; Data Structures and Algorithm Analysis in C; Second Edition; Pearson Education; 2002.

Reference Books:

1. Seymour Lipschutz; Data Structures; First Edition; McGraw Hill; 2006.
2. Yedidyah Moshe, J. Augenstein, Aaron M. Tenenbaum; Data Structures Using C; Second Edition; PHI publication.
3. Thomas Cormen, Charles Leiserson, Ronald Rivest and Clifford Stein, Introduction to Algorithms, Third Edition; Prentice Hall of India; 2009.

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

Course Code: 24EE05TH0505 – 3

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. Simon Haykin, *Communication Systems*, 4th edition, Wiley Publications, 2001.

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

Course Code: 24HS02TP0501

Course: Business Communication

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

Total Credits: 02

Course Objective

This course aims to develop students' competency in business communication by enabling them to analyze communication processes, apply effective writing and speaking strategies, and create professional content across written, oral, and digital platforms. It integrates practical training in persuasion, negotiation, teamwork, leadership, visual communication, and workplace tools, while emphasizing the ethical use of AI and prompt-based techniques for written communication in multicultural environments.

Course Outcomes:

1. Analyse communication processes and models to apply appropriate strategies in formal and informal workplace interactions.
2. Apply and demonstrate structured writing strategies and AI-assisted techniques to create effective business correspondence.
3. Develop and present structured business reports and visual content by integrating data visualization and AI tools effectively.
4. Apply interpersonal and persuasive communication, emotional intelligence, persuasion, negotiation, and leadership strategies to participate effectively in teamwork, conflict resolution, and employment processes.
5. Create and demonstrate professional communication across meetings, employment processes, and digital platforms by integrating AI tools ethically and effectively.

UNIT 1: Fundamentals of Business Communication

4 hours

Introduction to Communication: Nature and Purpose

Communication Models: SBAR Framework (Situation, Background, Assessment, Recommendation), Schramm's Interactive Model, Transactional Model (case-based)

UNIT 2: Business Correspondence

4 hours

Communication Planning and AI Integration: Planning Business Messages, Language and sensitivity to various audiences, Chat communication etiquette, Human-AI collaboration, Ethical use of AI

Routine Correspondence and prompt engineering: Internal Communication emails, Client emails, Escalation emails, Follow-up emails, Status update emails, Action confirmation emails, Use of AI Prompts for email drafting

UNIT 3: Business Reports

4 hours

Fundamentals of Business Reports: purpose, structure, and standard formats

Types of Reports and Professional Documents: feasibility, progress, and project reports; agenda, notices, minutes of meetings, and organizational announcements; writing a business case

AI-Assisted Report Writing: Use of AI prompts for planning, drafting, and structuring reports

UNIT 4: Employment and Workplace Tools

3 hours

Employment Communication: job descriptions, effective use of job portals (LinkedIn, Indeed, etc.), and AI in hiring

Workplace Etiquette and Ethics: professional and communication etiquette, ethical practices in organizational context

Workplace and AI Tools: use of collaboration tools (Slack, Teams, Signal App) and AI tools (Grammarly, Claude) for professional communication

Text Books:

1. Courtland L Bovee, John V Thill and Roshan Lal Raina “Business Communication Today”, 14th edition Pearson
2. P.D. Chaturvedi and Mukesh Chaturvedi, Fundamentals of Business Communication, Pearson Publications, 2012.

Reference Books:

1. Shalini Verma, Business Communication, Vikas Publishing House Pvt. Ltd., 2015.
2. Sanjay Kumar, Pushpa Lata, Communication Skills, 2nd Edition, Oxford Publication, 2018
3. Sharon Gerson, Steven Gerson, “Technical Communication: Process and Product”, 2018, Pearson
4. *The AI Prompt Handbook for Business Writing: 50+ Prompts for Professionals, Managers & Entrepreneurs (The AI Prompt Handbook Series)*, Maxwell Striling, 2026
5. Chris Duffey, Prompt Engineering for Business, Wiley 2024
6. Taner Mostafa, AI Prompts for Business Writing, 2023
7. <https://txwes.pressbooks.pub/bcomm/>

Practical 1: Verbal Communication- Formal

Topics covered: Channels- Formal and Informal: Vertical, Horizontal, Diagonal, Formal discussion, Types of meetings (SCRUM, status, planning, problem-solving, brainstorming), Giving and receiving feedback, communicating ideas when not assigned to a project

Suggested Activities: Client Call Simulations, Meeting and Feedback Exchange Role Plays

Practical 2: Verbal Communication- Informal

Topics covered: Grapevine communication, Informal discussions, Art of Small Talk, Self-Introduction (succinct manner)

Suggested Activities: Speed networking, Small Talk Circles,

Practical 3: Emotional Intelligence

Topics covered: Application of Transactional Analysis in workplace contexts (particularly in team and client interactions)

Suggested Activities: PAC Role Play, Reframing negative communication

Practical 4: Persuasive Communication

Topics covered: Persuasion vs. Manipulation, ARGU strategy, Rhetorical Principle, Strategies

Suggested Activities: Product Pitch, Business Storytelling

Practical 5: Negotiation and Conflict Management

Topics covered: Types of Conflicts, Causes of Conflicts, Concept of BATNA, Negotiation strategies, Understanding the Non-Disclosure Agreement

Suggested Activities: Negotiation and Conflict Resolution Case Scenarios, Diplomacy in Action

Practical 6: Group Dynamics and Leadership Skills

Topics covered: Stages of Group formation, Roles in teams, Leadership Styles, Strategies to be an effective leader

Suggested Activities: Role Plays on Leadership Styles, Role-based Team Discussions, Decision-Making Tasks

Practical 7: Visual Communication

Topics covered: Data Visualization (selecting visuals for presenting data) and Data Verbalization

Suggested Activities: Data to Visual Task

Practical 8: Employment and Workplace communication

Topics covered: Types of Resumes, Keyword Optimization, ATS-friendly resumes, Interview Questions, Answering structure, Body Language, Strategies for Effective Interviews

Suggested Activities: Resume Review, Mock Interviews(*involvement of industry also*), LinkedIn Optimization

SEMESTER – VI

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

Course Code: 24EE05TH0601

L: 3Hrs, T: 2Hr, P: 2 Hrs. Per week

Course: Wireless Communication

Total Credits: 04

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 Wiley, 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

List of Experiments – Wireless Communication

1. Simulation of Free Space, Two-Ray Ground Reflection and Okumura-Hata Propagation Models
2. Modeling and Simulation of Multipath Rayleigh and Rician Fading Channels
3. Simulation of Doppler Shift and Mobile Wireless Channel
4. BER Analysis of BPSK/QPSK over AWGN and Fading Channels
5. Direct Sequence Spread Spectrum (DSSS) Modulation and Demodulation
6. Simulation of Frequency Hopping Spread Spectrum (FHSS) System
7. Performance Analysis of TDMA, FDMA and CDMA Systems
8. Design and Simulation of OFDM System
9. Channel Equalization using Zero Forcing (ZF) and MMSE Equalizers
10. Adaptive Equalization using LMS Algorithm
11. Decision Feedback Equalizer (DFE) Simulation
12. Simulation of Channel Estimation Techniques in OFDM

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

Course Code: 24EE05TH0602

Course: Machine Learning

L: 3 Hrs, T: 0 Hr, P: 2 Hrs. Per week

Total Credits: 04

Course outcomes

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

1. Understand the scope and examples of machine learning.
2. Understand fundamentals of machine learning principles and algorithm.
3. Prepare clean data for machine learning.
4. Apply supervised and unsupervised learning models to solve problems.
5. Build Machine Learning applications to solve real life societal problems.

Unit I:

Introduction to Probability: Probabilities of events, random variables, joint distribution & densities, moments of random variables, estimation of parameters from samples, minimum risk estimators.

Unit II:

Introduction to Python toolkits: Matplotlib, NumPy, Scikit-learn, NLTK, Visualizing Data: Bar Charts, Line Charts, Scatterplots. Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction.

Unit III:

Overview of Machine learning concepts – Introduction to Bayes Theorem, Linear Regression-model assumptions, regularization. Over fitting and train/test splits, Types of Machine learning –Supervised, Unsupervised, Reinforced learning,

Unit IV:

Classification and Regression Algorithms- Introduction to Neural Networks, back-propagation algorithm, Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest and their classification Errors, Deep Learning, Case Studies of various machine learning algorithms for classification and regression.

Unit V:

Clustering: sequential clustering, hierarchical clustering, probabilistic clustering, partitional clustering, clustering for region segmentation,

Text Books:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media
2. Jeeva Jose, "Machine Learning", Khanna Publishing House, Delhi.

Reference Books:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press
<http://www.deeplearningbook.org>
2. Chopra Rajiv, "Machine Learning", Khanna Publishing House, Delhi.
3. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media
4. Artificial Neural Networks by B. Yegnanarayana

Experiments based on the following topics:

1. Introduction to tools for reading datasets, libraries and frameworks
2. Data Preprocessing
3. Visualization
4. Classification
5. Regression
6. Dimensionality Reduction
7. Clustering
8. Mini project based on societal real world problems

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

Course Code: 24EE05TH0603

Course: Internet of Things

L: 3 Hrs, T: 0 Hr, P: 2 Hrs. Per week

Total Credits: 04

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.

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:** Wired and Wireless communication, TCP IP configurations, SSH, Putty Terminal usage, Web page applications using Python.

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 Halfacree*, John Wiley & Sons, 2016

Experiment List – Internet of Things

Exp. No.	Aim
1	Install, configure, and use Raspberry Pi as a desktop computer for basic computing, internet access, and programming activities.
2	Understand and apply essential Linux commands required for Raspberry Pi programming and system management.
3	Install, configure, and verify essential libraries and packages required for GPIO, I2C, SPI, and UART communication on Raspberry Pi.
4	Develop simple Python applications on Raspberry Pi using packages for file handling, date-time operations, system monitoring, and data logging.
5	Interface ADC /DAC modules with Raspberry Pi for analog signal acquisition and analog output generation.
6	Interface different sensors with Raspberry Pi and acquire real-time physical parameters such as temperature, humidity, distance, motion, and light intensity.
7	Host and display real-time sensor readings on a web page using Raspberry Pi as a local server.
8	Design and implement a complete Raspberry Pi-based IoT application integrating sensors, actuators, Python programming, data logging, web visualization, and control/alert mechanisms.

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

Course Code: 24EE05TH0604 – 1

**Course: Smart Sensors
(Program Elective – 2)**

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.
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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 of Smart Sensors, Fiber optic sensors (Optical sensor), Accelerometer, Chemical sensors, biosensors, gas sensors, Industrial Application of 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, 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 edition.

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 VI, B. Tech. (Electronics and Communication Engineering)

Course Code: 24EE05TH0604 – 2

**Course: Design and Analysis of Algorithms
(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. Analyze efficiency (time/space complexity) of algorithms using mathematical formulation, and recurrence relations methodologies.
 2. Design algorithms for various computing problems
 3. Argue the correctness of algorithms using inductive proofs and invariants
 4. Apply Greedy and Divide & Conquer methodologies.
 5. Design Dynamic programming and Backtracking Paradigm to solve real-life problems.
-

UNIT I

Mathematical foundations for arithmetic and geometric series, Recurrence relations and their solutions, Principles of designing algorithms and complexity calculation, Asymptotic notations for analysis of algorithms, worst case and average case analysis, amortized analysis and its applications.

UNIT II

Divide and Conquer- basic strategy, Binary Search, Quick sort, Maximum sub-array problem, Closest pair of points problem, Convex Hull: Quick Hull, Graham's scan.

UNIT III

Greedy method – basic strategy, fractional knapsack problem, Minimum cost spanning trees, Huffman Coding, activity selection problem, find maximum sum possible equal to sum of three stacks.

UNIT IV

Dynamic Programming -basic strategy, Bellman ford algorithm, all pairs shortest path, multistage graphs, optimal binary search trees, traveling salesman problem, String Editing, Longest Common Subsequence problem and its variations.

UNIT V

Basic Traversal and Search Techniques, breadth first search and depth first search, connected components. Backtracking basic strategy, 8-Queen's problem, graph colouring, Hamiltonian cycles, sum of subset problem, Introduction to Approximation algorithm.

Text Books

1. Thomas H. Cormen et.al; "Introduction to Algorithms"; 3 Edition; Prentice Hall, 2009.
2. Horowitz, Sahani and Rajasekaram; "Computer Algorithms", Silicon Press, 2008.
3. Sridhar S.; "" Design and Analysis of Algorithms, Oxford University Press.
4. Brassard and Bratley; "Fundamentals of Algorithms", 1 Edition; Prentice Hall, 1995.
5. Richard Johnsonbaugh, "Algorithms", Pearson Publication, 2003.

Reference Books

1. Parag Himanshu Dave, Balchandra Dave, "Design and Analysis of Algorithms" Pearson Education, O'relly publication
2. Richard Johnsonbaugh, "Algorithms", Pearson Publication, 2003.

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

Course Code: 24EE05TH0604 – 3

**Course: Advanced Signal Processing
(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 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, R.J. 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: 24EE05TH0605 – 1

Course: System Verilog
(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:

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 SystemVerilog Assertions, *Srikanth Vijayaraghavan and Meyyappan Ramanathan*, 2005 ed., Springer Verlag
- 2) Digital Design and Computer Architecture: RISC-V Edition, *David Harris and Sarah Harris*, Morgan Kaufmann Publishers Inc
- 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: 24EE05TH0605 – 2

**Course: Database Management Systems
(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 students will be able to

1. Comprehend basic concepts of Database Systems and its Applications
2. Explain various file organizations and indexing techniques.
3. Use Structured Query Language (SQL) for database creation and interaction.
4. Analyze query processing its optimization and concurrency control
5. Design a database system.

Unit I:

Overview, File systems Vs DBMS, Database architectures, Data models, Levels of abstraction, Structures of DBMS, Relational model, Relations and Integrity constraints, Relational algebra.

Unit II:

Overview of database design, ER model, Features of ER model, Conceptual design using ER model, Scheme refinement, Use of decompositions, Functional dependencies, Normalization,

Unit III:

SQL query, Aggregate operators, Nested queries, Joins, Views, introduction to NoSQL databases such as MongoDB.

Unit IV:

Storage media, Buffer management, File organizations, Indexing, Hashing and external sorting.

Unit V:

Introduction to query processing, estimating the cost, Concepts of transaction, Transactions and schedules, concurrency control protocols, Introduction to crash recovery, Log recovery, Check pointing.

Text Books:

1. Database Systems Concepts - Henry Korth & Others, 6th Edition, TMH.
2. Fundamental of database system - 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: 24EE05TH0605 – 3

**Course: Speech and Audio Processing
(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:

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: 24EE05PR0607

Course: 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 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

SEMESTER – VII

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

Course Code: 24EE05TH0701

Course: 5G and Next Generation
Communication 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 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 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. 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: 24EE05TH0702

**Course: Computer Architectures
and Parallelism**

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 operation of uniprocessor computer components including the processor and memory hierarchy
2. Understand parallel hardware and general parallel program design techniques and patterns
3. Demonstrate an understanding of shared-memory machines
4. Demonstrate an understanding of distributed-memory machines
5. Analyze the performance of computational algorithms.

Unit I

Computational Model: Basic computational models, evolution and interpretation of computer architecture, concept of computer architecture as a multilevel hierarchical framework. Classification of parallel architectures, Relationships between programming languages and parallel architectures.

Unit II

Parallel Processing: Types and levels of parallelism, Instruction Level Parallel (ILP) processors, dependencies between instructions, principle and general structure of pipelines, performance measures of pipeline, pipelined processing of integer, Boolean, load and store instructions, VLIW architecture, Code Scheduling for ILP- Processors - Basic block scheduling, loop scheduling, global scheduling.

Unit III

Superscalar Processors: Emergence of superscalar processors, Tasks of superscalar processing – parallel decoding, superscalar instruction issue, shelving, register renaming, parallel execution, preserving sequential consistency of instruction execution and exception processing, comparison of VLIW & superscalar processors **Branch Handling:** Branch problem, Approaches to branch handling – delayed branching, branch detection and

prediction schemes, branch penalties and schemes to reduce them, multiway branches, guarded execution.

Unit IV

MIMD Architectures: Concepts of distributed and shared memory MIMD architectures, UMA, NUMA, CC-NUMA & COMA models, problems of scalable computers.

Direct Interconnection Networks: Linear array, ring, chordal rings, star, tree, 2D mesh, barrel shifter, hypercubes.

Unit V

Dynamic interconnection networks: single shared buses, comparison of bandwidths of locked, pended & split transaction buses, arbiter logics, crossbar, multistage networks – omega, butterfly Cache coherence problem, hardware based protocols – snoopy cache protocol, directory schemes, and hierarchical cache coherence protocols.

Text Books:

1. “Computer Architecture and Organization”, Hayes J. P, PHI, Second edition / Third edition
2. “Computer Organisation”, V. Carl Hammacher, Fifth Edition
3. An Introduction to Parallel Programming, Peter S. Pacheco, 2011, 1st Edition, Morgan Kaufmann Publishers, Print Book ISBN: 9780123742605 eBook ISBN: 9780080921440

Reference Books:

1. D. E. Culler and J. P. Singh with A. Gupta. Parallel Computer Architecture. Morgan-Kaufmann publishers.
2. J. L. Hennessy and D. A. Patterson. Computer Architecture: A Quantitative Approach, Morgan-Kaufmann publishers.

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

Course Code: 24EE05TP0703

Course: Digital Image Processing

L: 3 Hrs, T: 0 Hr, P: 2 Hrs. Per week

Total Credits: 04

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, Huffman 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.*

Digital Image Processing Lab

Sr. No.	Experiment Title	Course Outcome
1.	To write Matlab script for reading given colour image and inspect its attributes, show it in gray and binary, resize and crop form.	CO1
2.	To write Matlab script for performing quantization on given high resolution colour image to reduce colour depth.	CO1
3.	To write Matlab script for transforming image in frequency domain using DFT.	CO1, 2
4.	To write Matlab script for image analysis using DCT and Wavelet	CO2
5.	To write Matlab script for visualizing histogram of given image and perform histogram equalization for improving visual appeal of image.	CO3
6.	To write Matlab script for applying filter on a noisy image.	CO3,4
7.	To write Matlab script for applying filter in frequency domain on a noisy image.	CO3,4
8.	To write Matlab script for detecting edges, lines in a given image.	CO3,5
9.	To write Matlab script for applying Intensity slicing technique on an image.	CO3,5
10	To write Matlab script for compressing an image for a given compression factor.	CO3,5
11.	A mini Project based on image processing application.	CO5

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

Course Code: 24EE05TH0704 – 1

**Course: VLSI Technology
(Program Elective – 4)
Total Credits: 03**

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

Course outcomes

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

1. Describe diffusion and ion implantation processes and their role in controlling semiconductor device characteristics.
2. Analyze oxidation kinetics, dielectric materials, and contamination control techniques used in VLSI fabrication.
3. Compare photolithography, e-beam lithography, and advanced lithographic techniques for pattern generation in VLSI circuits.
4. Apply CVD and epitaxial growth methods for the deposition of thin films required in semiconductor manufacturing.
5. 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 nitride 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: 24EE05TH0704 – 2

**Course: Software Engineering
(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. Implement software engineering practices and various models.
2. Use software engineering process models in solving real-world problems.
3. Assess impact of software testing and project management approaches.
4. Apply approaches to assessment of software quality, risk and change.

Unit I

Introduction to Software Engineering, Software engineering principles, Software Myths, Software Engineering- A Layered Technology, Software Process Framework, Requirements Engineering Tasks, Requirement Engineering Process, Eliciting Requirement.

Unit II

Software Process Models, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, The Unified Process Model, Agile Process Models: Extreme Programming (XP), Scrum.

Unit III

An overview, Requirements Analysis, Analysis Modeling Approaches, Data Modeling, Class-based Modeling, Scenario-Based Modeling, Flow-Oriented Modeling, Behavioral Model. Design Engineering Concepts, Design Model. Software reengineering, Reverse engineering.

Unit IV

Software Testing fundamentals, Testing Life Cycle, Structural Testing, Functional Technique, Static testing, Dynamic testing, Unit Testing, Integration Testing, Validation Testing, System Testing, Debugging. Black Box Testing, White Box Testing, Web Testing,

Automated Testing.

Unit V

Software Project management- Plans and Methods. Project management concept, Project Evaluation, Cost-benefit evaluation technique, Software Effort Estimation-Albrecht Function Point Analysis, COSMIC Function Point, Cost Estimation, COCOMO Model. Software Quality, Achieving Software Quality, Software Measurement, Metrics for Software Quality; Quality Management - Concepts, Software Quality Assurance. Risk management - Risk strategies, Software risks, Risk identification, Risk refinement, RMMM, Software Reviews, Formal Technical Review; Software Configuration Management, SCM Repository, SCM Process, Software reengineering, Reverse engineering.

Text books

1. Roger Pressman; Software Engineering-A Practitioner's Approach; Seventh Edition, McGraw Hill, 2010.
2. Ian Somerville; Software Engineering; Seventh Edition; Pearson Education. 2008.
3. Rajib Mall, Software Project Management, 5th Edition, McGrawHill.

Reference Books

1. David Gustafsan, Software Engineering; Schaum's Series, Tata McGraw Hill, 2002.
2. Software engineering: a precise approach, Pankaj Jalote, 3rd edition, Wiley India, 2010.
3. Object-Oriented Software Engineering: Practical Software Development Using UML and Java by Timothy Lethbridge, Robert Laganier, McGraw-Hill, 2002.
4. Ethics in Information Technology, George W. Reynolds, 4th Edition, Cengage Learning Publication.

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

Course Code: 24EE05TH0704 – 3

**Course: RTOS and Kernels
(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 Operating Systems fundamentals in general and specific to real time systems.
 2. Identify scheduling and its type for system performance.
 3. Explore kernel objects in operating systems for real time system.
 4. Evaluate the system performance considering memory Management and File I/O management schemes.
 5. Compile and deploy a real time operating system from nano-kernel to complex system.
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Unit –I: RTOS Overview:

Computer System Structure, What is an Operating System (OS)? Function of OS, OS Interaction with Computer and User Programs Different Classes of OS, Operation of OS, Structure of OS. Process, Task and Thread: Processes and Programs, Programmer view of processes, Implementation of Processes, Interaction between Processes, Threads and its types.

Unit – II: Scheduling:

Levels of Scheduling, Scheduling Algorithms: Non-pre-emptive Pre-emptive, Quantum Size, Priority, Performance Evaluation, Real Time Scheduling, Aperiodic RT scheduling. Concurrency Scheduling, Multiprocessing environment, Read-write by multiple CPUs and consistency problem Solutions with Mutual Exclusion, Hardware Mutex, Software Mutex Example: Dekker's algorithm, Use of Semaphore and preventing busy waiting Message passing and Mail box for communication, Deadlock and Solutions

Unit –III:

Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem Exceptions, Interrupts and Timers Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

Unit – IV: Memory Hierarchy and Virtual Memory:

Cache and its types, Cache Policy.

Memory map, Memory management, Address binding and dynamic binding, Relocation register, Memory Partitioning. Virtual memory: Buddy memory and non-contiguous memory allocation, Paging, Translation Lookaside Buffer (TLB), Multilevel Page Table, Segmentation with Paging, **Virtual memory** :Paging and Handling Page Fault, Fetching and replacing Pages, Working Set Model, Virtual Memory and multiprogramming

Unit –V: File System and I/O:

File structure and directory structure, File attributes Open Files, Allocation methods, Accessing a file, disk Disk and I/O scheduling, I/O, Direct control, Interrupt and DMA

RTOS :

Case Studies of RTOS RT Linux, MicroC/OS-II, VxWorks, Embedded Linux, and Tiny OS Structure of RTOS and RTOS Kernels architecture, Applications of RTOS, Task and Time Management, Data Sharing, Performance Evaluation and debugging

Text Books:

1. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011

Reference Books:

1. Embedded Systems- Architecture, Programming and Design by Rajkamal, 2007, TMH.
2. Advanced UNIX Programming, Richard Stevens
3. Embedded Linux: Hardware, Software and Interfacing – Dr. Craig Hollabaugh

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

Course Code: 24EE05TH0705 – 1

**Course: Introduction to MEMS
(Program Elective – 5)**

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 evolution and classification of MEMS.
2. Understand the working principle of micro 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 and structures definitions. Materials used in MEMS 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.

Unit V

Mechanics of solids: Stresses, Strain, Hookes's law, Poisson effect, Overview of Finite Element Method.

Text Books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E. Lyshevski, Nano and Micro-Electromechanical systems: Fundamentals of Nano and Micro engineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 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, New York, 2000.

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

Course Code: 24EE05TH0705 – 2

**Course: Computer Vision
(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 the concepts of Image formation and processing.
 2. Understand human vision system in context to machine vision.
 3. Comprehend Machine Learning fundamentals.
 4. Comprehend computer vision algorithms, methods and concepts.
 5. Implement computer vision algorithms for an application.
-

Unit –I:

Introduction to Computer Vision and Basic Concepts of Image Formation: Introduction and Goals of Computer Vision and Image Processing, Image Formation Concepts.

Unit – II:

Fundamental Concepts of Image Formation: Radiometry, Geometric Transformations, Geometric Camera Models, Camera Calibration, Image Formation in a Stereo Vision Setup, Image Reconstruction from a Series of Projections.

Unit –III:

Image Processing Concepts: Pre-processing concepts, Basics of Color image processing: Color fundamentals, color models, color transformation, color segmentation, smoothing, and sharpening.

Unit – IV: Image Descriptors and Features: Texture Descriptors, Color Features, Edges/Boundaries. Object Boundary and Shape Representations. Interest or Corner Point Detectors, Histogram of Oriented Gradients, Scale Invariant Feature Transform, Speeded up Robust Features, Saliency

Unit –V:

Fundamentals of Machine Learning: Linear Regression, Basic Concepts of Decision Functions, Elementary Statistical Decision Theory, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction, Linear Discriminant Analysis

Applications of Computer Vision: Artificial Neural Network for Pattern Classification, Convolutional Neural Networks, Autoencoder, Machine Learning Algorithms and their Applications and case studies.

Text Books:

1. Forsyth & Ponce, “Computer Vision-A Modern Approach”, Pearson Education.
2. M.K. Bhuyan , “ Computer Vision and Image Processing: Fundamentals and Applications”, CRC Press, USA, ISBN 9780815370840 - CAT# K338147.

Reference Books:

1. Richard Szeliski, “Computer Vision- Algorithms & Applications”, Springer.

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

Course Code: 24EE05TH0705 – 3

**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-hoc Networks (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: 24EE05PR0707

Course: Project Phase – II

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 Project Phase – II

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: 24EE05TH0801 – 1

**Course: RF Circuit Design
(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 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 Press

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: 24EE05TH0801 – 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: 24EE05TH0801 – 3

**Course: Microwave Theory and Techniques
(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 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 VIII, B. Tech. (Electronics and Communication Engineering)

Course Code: 24EE05TH0802 – 1

**Course: Design for Testability
(Program Elective – 7)**

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

Total Credits: 03

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

Course Code: 24EE05TH0802 – 2

**Course: Artificial Intelligence
(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 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 VIII, B. Tech. (Electronics and Communication Engineering)

Course Code: 24EE05TH0802 – 3

**Course: Cryptography and Network Security
(Program Elective – 7)**

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. 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.
-

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. Organizational Security: Information Technology and Security Management, Standards: ISO27001/ ISO27002/ISO27005, Risk Management

Unit IV

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 V

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.

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 VIII, B. Tech. (Electronics and Communication Engineering)

Course Code: 24EE05PR0707803

Course: Project Phase – III

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 Phase – III

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: 24EE05PR0707804

Course: Full Semester 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.

MDM COURSES

(Embedded Systems and IoT Track)

**Syllabus for Semester III,
(MDM – 1 [Embedded Systems and IoT Track])**

Course Code: 24EE05TH0306 – 1

Course: Sensors for IoT
(MDM Course)

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

Total Credits: 03

- CO1** Understand the definitions, classifications, and characteristics of sensors and actuators.
CO2 Illustrate the working principles and characteristics of physical sensing mechanisms.
CO3 Explain the types, principles, and control mechanisms of actuators.
CO4 Interpret the structure, function, and communication of smart sensors.
CO5 Select suitable sensors/actuators for a given application and analyze constraints.
-

Unit I: Introduction to Sensors and Transducers

- Definitions: Sensor, Transducer, Actuator
 - Classification of sensors and actuators
 - Based on signal type: Analog/Digital
 - Based on energy domain: Active/Passive, Mechanical, Electrical, Thermal
 - Measurement system: block diagram
 - Static and dynamic characteristics: accuracy, resolution, drift, linearity, hysteresis
 - Error sources, standards, and calibration procedures
-

Unit II: Physical Sensing Mechanisms and Sensors

- **Mechanical/Displacement Sensors:** Potentiometers, LVDT, capacitive sensors
 - **Thermal Sensors:** Thermistor, RTD, Thermocouples – characteristics and comparison
 - **Pressure/Force Sensors:** Strain gauge (resistive), piezoelectric sensors
 - **Motion and Acceleration:** MEMS accelerometers, gyroscopes
 - **Light and Radiation:** LDR, photodiode, phototransistor, photoconductive and photovoltaic sensors
 - **Chemical and Bio-sensors:** Gas sensors (MQ series), pH sensors, glucose, ECG, SpO₂
-

Unit III: Actuators and Their Operating Principles

- Classification of actuators: mechanical, electrical, fluidic
 - **Electromagnetic Actuators:** DC motors, stepper motors, servo motors – working and control
 - **Thermal Actuators:** Shape memory alloys (SMA), thermopiles
 - **Piezoelectric Actuators:** Operating principle and applications
 - **Hydraulic and Pneumatic Actuators:** Force generation and control applications
 - Signal conditioning and driver circuits (qualitative overview)
-

Unit IV: Smart Sensors

- Smart sensors: architecture, on-chip signal processing, self-calibration
 - Comparison between conventional and smart sensors
 - Digital communication protocols: UART, I2C, SPI (basics only)
 - Microelectromechanical Systems (MEMS): basics, applications in sensing and actuation
 - Miniaturization and integration trends in sensor-actuator systems
-

Unit V: Sensor and Actuator Selection and Applications

- Selection criteria for sensors and actuators: range, sensitivity, resolution, linearity, power
 - Case studies in:
 - **Industrial Automation:** position sensing, pressure control
 - **Health Care Systems:** wearable sensors, haptic feedback
 - **Automotive:** proximity sensors, throttle/steering actuators
 - **Consumer Electronics:** touch sensors, vibration motors
 - Reliability, environmental considerations, lifecycle, cost constraints
-

Textbooks

1. **Clarence de Silva**, *Sensors and Actuators: Engineering System Instrumentation*, CRC Press
 2. **E. A. Doebelin**, *Measurement Systems: Application and Design*, McGraw-Hill
-

**Syllabus for Semester IV,
(MDM – 2 [Embedded Systems and IoT Track])**

Course Code: 24EE05TH0408 – 1 **Course:** Microcontrollers and IoT Applications
(MDM Course)

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:

CO1: Understand the architecture and features of modern microcontrollers with a focus on ESP32.

CO2: Interface ESP32 with sensors, actuators, and communication modules.

CO3: Develop embedded software for data acquisition, control, and IoT communication.

CO4: Implement basic IoT projects using Wi-Fi, Bluetooth, and cloud services.

CO5: Analyze and optimize IoT solutions for power, connectivity, and scalability.

Module 1: Introduction to IoT and Microcontrollers

- What is IoT? Applications and Ecosystem
- Role of microcontrollers in IoT
- Comparison: Arduino, ESP8266, ESP32, Raspberry Pi Pico
- Introduction to ESP32: Features, architecture, GPIO, memory, peripherals

Lab: Setting up ESP32 with Arduino IDE

Module 2: ESP32 Programming Fundamentals**

- GPIO programming
- Digital and analog I/O
- Pulse Width Modulation (PWM)
- Interrupt handling

Lab: Blinking LED, Button control, PWM control of LED/Buzzer

Module 3: Sensors and Actuators Interfacing

- Analog sensors: Temperature, light
- Digital sensors: DHT11, Ultrasonic
- Actuators: Relays, motors
- ADC and DAC with ESP32

Lab: Sensor reading and data display on serial monitor or OLED

Module 4: Communication Interfaces

- I2C and SPI with ESP32
- UART communication
- Interfacing external modules like RFID, OLED, GPS

Lab: I2C OLED display + SPI sensor module integration

Module 5: Wireless Communication

- ESP32 Wi-Fi setup and connectivity
- Web server creation with HTML/CSS
- Bluetooth Classic and BLE communication
- MQTT protocol and cloud integration (e.g., ThingSpeak, Blynk, Firebase)

Lab: IoT weather station (sensor → Wi-Fi → cloud dashboard)

Module 6: Power Management & Deployment

- Deep sleep modes and power optimization
- Battery and solar power options
- Flashing, OTA updates
- Case study: Real-world IoT deployments using ESP32

Lab: ESP32 deep sleep + wakeup using timer or sensor

Mini Project (Final Assessment)

Each student/team will build a basic IoT system (e.g., smart home device, weather station, security alarm) using ESP32, sensors, and cloud integration.

Tools and Platforms:

Hardware: ESP32 DevKit, sensors, actuators, breadboard, jumper wires

Software: Arduino IDE, Blynk/ThingSpeak/Firebase, MQTT Broker

Languages: C/C++

**Syllabus for Semester V,
(MDM – 3 [Embedded Systems and IoT Track])**

Course Code: 24EE05TH0507-1

**Course: IoT System Architecture
(MDM Course)**

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:

- CO1:** Explain IoT layered architecture and core system components.
- CO2:** Compare IoT communication protocols and networking technologies.
- CO3:** Analyze edge–fog–cloud architectures and deployment strategies.
- CO4:** Evaluate IoT security, privacy, and risk mitigation mechanisms.
- CO5:** Design conceptual IoT architectures for domain-specific applications.

Module 1: IoT Fundamentals and Architecture Models

- Evolution of IoT and its characteristics
- IoT ecosystem and stakeholders
- IoT vs M2M vs Cyber-Physical Systems
- 3-layer and 5-layer architecture models
- Functional blocks of IoT systems
- IoT reference architecture
- IPv6 in IoT and device addressing
- Middleware in IoT
- Scalability, reliability and heterogeneity challenges

Module 2: IoT Communication & Networking Technologies

- OSI vs TCP/IP model in IoT
- IPv4 vs IPv6
- Wi-Fi, Bluetooth, ZigBee, NFC
- LoRa, NB-IoT, Sigfox, 5G
- Application protocols: MQTT, CoAP, HTTP
- Transport protocols: TCP vs UDP
- QoS levels in MQTT
- Data formats: JSON, XML, CBOR
- Protocol selection strategy and interoperability

Module 3: Edge, Fog and Cloud Computing in IoT

- Cloud computing models: IaaS, PaaS, SaaS
- IoT cloud platforms overview
- Edge computing architecture and analytics
- Fog computing architecture
- IoT gateway architecture
- Edge vs Cloud comparison
- Data lifecycle in IoT
- Scalability, latency and cost-performance trade-offs

Module 4: IoT Security, Privacy and Risk Management

- CIA triad and threat modeling
- Device authentication mechanisms
- Symmetric and asymmetric encryption
- TLS/SSL and PKI in IoT
- Role-Based Access Control (RBAC)
- Common IoT attacks (DoS, Replay, MITM, Botnets)
- Privacy issues and regulatory considerations
- Security-by-design principles

Module 5: IoT System Design and Case Studies

- IoT system design methodology
- Requirement and stakeholder analysis
- Technology and protocol selection
- Smart City architecture
- Industrial IoT (IIoT)
- Smart Agriculture systems
- Healthcare IoT systems
- Emerging trends: AIoT, Digital Twin, Green IoT

**Syllabus for Semester VI,
(MDM – 4 [Embedded Systems and IoT Track])**

Course Code: 24EE05TH0608 – 1

**Course: Use Cases of IoT
(MDM Course)**

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:

CO1: Identify and explain major real-world applications of IoT across different domains.

CO2: Analyze architecture and technology stack used in various IoT use cases.

CO3: Evaluate challenges, risks, and scalability aspects of IoT deployments.

CO4: Compare domain-specific IoT solutions based on performance, cost, and sustainability.

CO5: Design conceptual IoT use-case solutions for real-world problems.

Module 1: Smart Home and Consumer IoT Use Cases

- Introduction to IoT use cases and application domains
- Smart home automation systems
- Smart lighting and HVAC systems
- Home security and surveillance systems
- Wearable devices and fitness tracking
- Voice assistants and connected appliances
- Architecture of smart home systems
- Benefits and limitations of consumer IoT

Module 2: Smart City and Infrastructure Use Cases

- Smart traffic management systems
- Smart parking systems
- Waste management and smart bins
- Environmental monitoring systems
- Smart street lighting
- Public safety and surveillance
- Smart energy grids and metering
- Challenges in urban IoT deployment

Module 3: Industrial and Manufacturing IoT (IIoT)

- Industrial IoT overview
- Predictive maintenance systems
- Asset tracking and monitoring
- Supply chain and logistics monitoring
- Remote monitoring of industrial equipment
- SCADA and automation integration
- Industrial communication protocols

- Cost-benefit analysis in IIoT

Module 4: Healthcare and Agriculture IoT Use Cases

- Healthcare IoT (IoMT) overview
- Remote patient monitoring
- Smart medical devices
- Wearable health sensors
- Smart agriculture systems
- Precision farming and irrigation control
- Livestock monitoring systems
- Challenges in healthcare and agriculture IoT

Module 5: Emerging IoT Use Cases and Future Trends

- AIoT (Artificial Intelligence of Things)
- Digital Twin applications
- Autonomous vehicles and connected transportation
- Smart energy management systems
- IoT in education and retail
- Green IoT and sustainability
- Blockchain integration in IoT
- Future research directions in IoT use cases

MDM COURSES

(Communication Engineering Track)

**Syllabus for Semester III,
(MDM – 1 [Communication Engineering Track])**

Course Code: 24EE05TH0306 – 2

**Course: Fundamentals of Communication
(MDM Course)**

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 components of analog and digital communication systems
2. Interpret sampling, quantization, and various pulse code modulation techniques
3. Compare different digital modulation techniques
4. Illustrate and differentiate various multiplexing and multiple access techniques
5. Analyze spread spectrum modulation schemes

Unit - I Basics of Communication System

Introduction to communication system, Need for modulation, Amplitude Modulation, Angle Modulation, Frequency Spectrum Analysis of AM and FM, Noise in analog communication

Unit - II Pulse Code Modulation Techniques

PAM, PWM, PPM, Sampling, Quantization, Pulse code modulation (PCM), Differential pulse codemodulation (DPCM), Delta modulation (DM), Adaptive Delta modulation (ADM), Signal to Noise ratio in PCM and DM, Line coding

Unit - III Digital Modulation Techniques

Shift keying techniques: Amplitude ShiftKeying (ASK), Frequency Shift keying (FSK), Phase Shift keying (PSK), Differential Phase Shift keying (DPSK), Quadrature Phase Shift keying (QPSK), M-ary FSK and M-ary PSK, Quadrature amplitude modulation (QAM)

Unit - IV Multiple Access Technique and Spread Spectrum (SS) Modulation

Time Division Multiple Access (TDMA), Frequency Division Multiple Access (FDMA), Code Division Multiple Access (CDMA), Spread Spectrum, Pseudo noise Sequences, Direct sequence spread spectrum (DSSS), Frequency hopped spread spectrum, slow and fast

frequency hopping

Unit - V Introduction to information theory and coding

Information Theory, Channel capacity theorem, Entropy, Source coding: Huffman coding, Error detection codes: Cyclic Redundancy Check (CRC) code and Checksum code, linear block code, error correction capability

Text Books

1. Simon Haykin, Digital communications, John Wiley and sons, 1998
2. B.P. Lathi Modern digital and analog communication systems, 3rd Edition, Oxford University Press

Reference Books

1. Wayne Tomasi, Electronic communications system, Pearson Education, 20
2. Bernard Sklar, Digital Communications: Fundamentals and Applications, Pearson 2021, ISBN-9780134588568

**Syllabus for Semester IV,
(MDM – 2 [Communication Engineering Track])**

Course Code: 24EE05TH0408 – 2

**Course: Mobile Communication
(MDM Course)**

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. Realize the evolution of wireless communication technologies
2. Explain cellular system concepts such as frequency reuse, handoff strategies
3. Compare different wireless standards
4. Analyze the architecture and protocols of 2G and 3G cellular systems
5. Interpret next generation wireless technologies like LTE, MIMO, NOMA etc.

UNIT I: Introduction to Wireless Communication System:

Evolution of mobile communications, Trend in Cellular radio and personal communication, Cellular Network structure, Wireless Local Area network , Personal Area Networks, Concepts of small and large scale fading, delay spread

UNIT II – 2G and 3G Cellular Systems

The Cellular Concept- frequency reuse, Channel Assignment Strategies, Channel & co-channel interference reduction, Handoff Strategies, Improving Coverage & Capacity in Cellular System, GSM Architecture, overview of UMTS Architecture, Handover

UNIT III – Mobile Communication Standards

IEEE 802.11 WLAN standard and its variants, IEEE 802.15 WPAN standard, IEEE 802.16 Wireless broadband access standard, PHY and MAC layer overview, WiMAX network architecture, Initialization and handover procedures

UNIT IV – Beyond 3G

HSPA and LTE, Architecture, Radio interface and channels, Quality of Service, OFDM, NOMA, Heterogeneous Networks, Internetworking, MIMO Systems, Beamforming Techniques

Unit V - Recent Trends in mobile communication

Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software-Defined Radio, UWB Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network.

Text Books:

1. Wireless Communication, Theodore S. Rappaport, Prentice hall
2. Mobile Communications Engineering, William C. Y. Lee, Mc Graw Hill Publications

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.

**Syllabus for Semester V,
(MDM – 2 [Communication Engineering Track])**

Course Code: 24EE05TH0507 – 2

**Course: LTE Technologies
(MDM Course)**

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 the evolution of mobile communication systems from 3G to 4G (LTE) and outline basic 5G concepts.
2. Describe the working principles of OFDM and its role in modern wireless communication systems.
3. Illustrate the concepts of cyclic prefix and channel estimation for improving communication reliability.
4. Analyze the LTE architecture and radio interface components.
5. Interpret LTE access procedures and basic resource allocation mechanisms.

Unit 1:

Evolution of Wireless Communication: Evolution of mobile communication systems from 1G to 5G, key technological advancements and performance improvements across generations, limitations of 2G and 3G systems leading to the need for LTE, key features of LTE such as high data rate and low latency, basic introduction to 5G and its applications, and overview of spectrum bands including low, mid, and high frequency ranges.

Unit 2:

OFDM – Foundation of Modern Wireless Systems:

Single-carrier and multi-carrier modulation techniques, introduction to Orthogonal Frequency Division Multiplexing (OFDM), role of FFT/IFFT in OFDM systems (conceptual understanding), advantages and limitations of OFDM, and importance of cyclic prefix in mitigating multipath effects.

Unit 3:

OFDM in Wireless Channels: Multipath fading and its effects on OFDM signals, inter-symbol interference and its impact on communication, role and importance of cyclic prefix,

basic concept of channel estimation in OFDM systems, and use of pilot symbols for channel estimation.

Unit 4:

LTE Architecture & Interface: LTE overview and objectives, LTE architecture: E-UTRAN, EPC, LTE frame structure, Types of LTE channels (logical, transport, physical – overview) , FDD vs TDD (simple comparison)

Unit 5:

LTE Procedures: Basic resource allocation in LTE (time-frequency grid concept), LTE initial access procedure (cell search), Random Access Channel (RACH) and its steps (high-level), and introduction to scheduling and HARQ mechanisms.

Textbooks & References:

- **Sesia, S., Toufik, I., & Baker, M.** – *LTE – The UMTS Long Term Evolution: From Theory to Practice*, Wiley
- **Holma, H., & Toskala, A.** – *LTE for UMTS – OFDMA and SC-FDMA Based Radio Access*, Wiley

**Syllabus for Semester VI,
(MDM – 2 [Communication Engineering Track])**

Course Code: 24EE05TH0608 – 2

**Course: 5G and 6G Systems
(MDM Course)**

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 key features, architecture, and performance goals of 5G.
2. Describe real-world use cases of 5G
3. Apply knowledge of spectrum usage, access technologies in 5G networks.
4. Examine 5G NR architecture and physical layer operations
5. Evaluate emerging 6G trends with respect to their potential impact on future wireless

Unit 1:

Introduction to 5G Technology: Key features of 5G: high speed, low latency, and large capacity, 5G network architecture: core and radio access network, Concepts of Massive MIMO and Beamforming, 5G system parameters and performance goals

Unit 2:

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 3:

5G Applications and Use Cases: 5G in IoT and smart devices, Use of 5G in autonomous vehicles, Smart cities and connected infrastructure, Role of 5G in Industry 4.0 (factories, automation, robotics), Real-world case studies of 5G deployment

Unit 4:

5G Deployment and Challenges: Spectrum management in 5G (low-band, mid-band, mmWave), Security issues and solutions in 5G networks, Interoperability and standardization (3GPP, ITU), 5G access techniques: OFDMA, NOMA, 5G channel coding (LDPC, Polar codes) and modulation

Unit 5:

Introduction to 6G and Future Trends: Vision and goals of 6G: higher speeds, lower latency, more intelligence, Use of AI and Machine Learning in future wireless networks, Role of Edge Computing in 6G, Emerging technologies: Reconfigurable Intelligent Surfaces (RIS), THz communication, Research trends in 5G and 6G

TEXT BOOKS:

4. Afif Osseiran, Jose F Monserrat, Patrick Marsch, “5G Mobile and Wireless Communications Technology”, Cambridge University Press, 2016
5. Saad Z. Asif, “5G Mobile Communications Concepts and Technologies”, CRC Press, Taylor & Francis Group, First Edition, 2018

REFERENCE BOOKS:

3. Ali Zaidi, Fredrik Athley, Jonas Medbo, Ulf Gustavsson, Giuseppe Durisi, Xiaoming Chen, “5G Physical Layer, Principles, Models and Technology, Components, Academic Press, 2018.
4. Harri Holma, Antti Toskala, Takehiro Nakamura, “5G Technology 3GPP NEW RADIO”, John Wiley & Sons, First Edition, 2020

HONORS COURSES

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

Course Code: 24EE05HT0301

**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
-

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: 24EE05HT0401

**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 VoIP, network convergence, Needs of individual users, enterprises and network operators. How VoIP 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, MGACO 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: 24EE05HT0501

**Course: Advanced Digital Communication
(HONORS Course)**

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

Total Credits: 04

Course outcomes

After completion of this course, the students will be able to understand:

1. Explain various performance parameters of Digital Communication system
 2. Analyze fading in dispersive Channels and its equalization techniques
 3. Examine/ experiment various Error control coding techniques and its performance
 4. Appraise Wireless communication systems
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Unit – I:

Fundamentals: Fundamentals of digital communication, transmit power and bandwidth, popular digital modulation schemes, noise processes and error probability, Shannon capacity formula for the additive white Gaussian noise (AWGN) channel

Unit – II:

Channels and Equalization: Fading dispersive channels and equalization, Transmit domain equalization using orthogonal frequency division multiplexing (OFDM). Receive domain Viterbi equalization, Channel estimation using pilots, Blind equalization, Decision feedback equalization, Carrier and timing synchronization

Unit – III:

Introduction to Error Control Coding: Introduction to error control coding, Linear block codes, Convolutional codes and Viterbi decoding, Turbo codes, low density parity check (LDPC) codes and message passing decoders, Performance of coding schemes and achieving the Shannon Limit in binary input channels, Coded Modulation, Recent advances in coding theory (such as Polar codes)

Unit – IV:

Introduction to Wireless Communications: User multiplexing in uplink and downlink

wireless systems, Transmit beamforming, Zero forcing and MMSE based receivers, wireless channel capacity, Introduction to Multiple-Input Multiple-Output (MIMO) and diversity, Recent advances in wireless communications with topics such as Massive MIMO and channel effects, Point to point communication using massive MIMO, Channel capacity improvements using massive MIMO, Applications in millimeter wave systems

Unit – V:

Applications and advanced topics: Selected topics and recent advances in digital communication, such as new waveforms for high mobility channels and orthogonal time-frequency-space (OTFS) modulation, filter bank multi-carrier (FBMC) modulation, Low power long range communication: frequency shift keying (FSK) and chirp based schemes, Molecular communication, Intelligent antennas, coherent optical communications.

Text Books:

1. Upamanyu Madhow, Fundamentals of Digital Communication, Cambridge University Press 2008. ISBN: 97805218741442.
2. Proakis, J. G., and M. Salehi. Communication Systems Engineering. 3rd ed. Englewood Cliffs, NJ: Prentice-Hall, 2004. ISBN: 0130617938.3.
3. Wozencraft, J. M., and I. M. Jacobs. Principles of Communication Engineering. New York, NY: Wiley, 1965. ISBN: 0471962406.4.

Reference Books:

1. P. P. Vaidyanathan and S. Phoong, Signal Processing and Optimization for Transceiver Systems. Cambridge University Press 2010, Online ISBN: 97811390427415.
2. Marzetta, T. L. and Larsson, E. G. and Hong Yang and Hien Quoc Ngo, "Fundamentals of Massive MIMO"; Cambridge University Press 2016, ISBN: 97813167998956.
3. Lecture notes from "Principles of Digital Communications – II" in MIT OpenCourseWare: https://ocw.mit.edu/courses/6-451-principles-of-digital-communication-ii-spring-2005/resources/mit6_451s05_fulllecnotes/

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

Course Code: 24EE05HT0601

**Course: Millimeter Wave Communication
(HONORS Course)**

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

Total Credits: 04

Course outcomes

After completion of this course students will be able to understand:

1. Explain millimeter wave characteristics, propagation mechanisms, and emerging applications.
2. Apply knowledge of large-scale and small-scale propagation effects, path loss, and directivity in millimeter wave systems.
3. Analyze modulation techniques and transceiver design for millimeter wave communication systems.
4. Analyze Massive MIMO systems and resource allocation strategies.
5. Evaluate beamforming techniques for millimeter wave and 5G communications.

Unit 1

Millimeter wave characteristics – Millimeter wave characteristics, Radio wave propagation for mm wave, emerging applications of millimeter wave communications.

Unit II

Radio Wave propagation for mm wave: Large-scale propagation channel effects, small-scale channel effects, Path loss, directivity

Unit III

Millimeter wave Communication Systems: Modulations for millimeter wave communications: OOK, PSK, FSK, QAM, OFDM, Transceiver architecture, Millimeter wave calibration, Millimeter wave design considerations.

Unit IV

Millimeter Wave MIMO Systems: Massive MIMO Communications, Noise coupling in MIMO systems, Dynamic spatial, frequency and modulation allocation.

Unit V

Millimeter Wave Beamforming: Antenna beam width, polarization, advanced beam steering and beam forming, mm wave design consideration, Implementation for mm wave in adaptive antenna arrays, Device-to-Device communications over 5G systems.

Text Books:

6. K.C. Huang, Z. Wang, "Millimeter Wave Communication Systems", Wiley-IEEE Press, March 2011.
7. Robert W. Heath, Robert C. Daniel, James N. Theodore S. Rappaport, Murdock, "Millimeter Wave Wireless Communication", Prentice Hall, 2014.

Reference Books:

1. Jonathan Wells, "Multi-Gigabit Microwave and Millimeter-Wave Wireless Communications", Artech House, 2010.
2. Xiang, W; Zheng, K; Shen, X.S; "5G Mobile Communications: Springer, 2016.

MINOR COURSES

Syllabus for Semester III,

B. Tech. (Electronics and Communication Engineering – MINOR)

Course Code: 24EE05MT0301

**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: 24EE05MT0401

**Course: Sensors for
Intelligent Instrumentation
(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: 24EE05MT0501

**Course: IoT for Industrial Application
(MINOR Course)**

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

Total Credits: 04

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.
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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 Halfacree, John Wiley & Sons, 2016

Syllabus for Semester VI,

B. Tech. (Electronics and Communication Engineering – MINOR)

Course Code: 24EE05MT0601

**Course: Future Generation Networks
(MINOR Course)**

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

Total Credits: 04

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.