RBU

RAMDEOBABA UNIVERSITY, NAGPUR

Formerly Shri Ramdeobaba College of Engineering & Management (RCOEM) Est. 1984

RAMDEOBABA UNIVERSITY, NAGPUR–440013

Established by the Maharashtra Private Universities (Establishement 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

of First Year as per National Education Policy (NEP)

(With effect from Academic Year 2026-27)

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	26HS03TP0104	Engineering Mathematics I	3	2	4	50+25	50+25	100+50	3
2	BSC	26HS05TP0102	Semiconductor Physics	3	2	4	50+25	50+25	100+50	3
3	PCC	26EE05TH0101	Network Theory	2	0	2	50	50	100	2
4	ESC	26EE05TP0102	Fundamentals of Programming	4	2	5	50+25	50+25	100+50	3
5	AEC	26HS02TP0101	Foundations of Business English	2	2	3	50+25	50+25	100+50	2
6	VEC	26HS02TH0103 – 2	Foundational course in Universal Human Values	1	0	1	50	0	50	-
			TOTAL	**15**	**8**	**19**				

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	26HS03TH0214	Engineering Mathematics II	3	0	3	50	50	100	3
2	PCC	26EE05TP0201	Electronic Devices and Circuits	3	2	4	50+25	50+25	100+50	3
3	ESC	26EE05TP0202	Data Structures and Algorithms	3	2	4	50+25	50+25	100+50	3
4	PCC	26EE05TP0203	Digital Circuits	3	2	4	50+25	50+25	100+50	3
5	PCC	26EE05TH0204	Signals and Systems	3	0	3	50	50	100	3
6	IKS	26HS02TH0203 – 1	Foundational Literature of Indian Civilization	1	0	1	50	-	50	-
7	CCA	26HS04PR0201	Health-Fitness-Wellbeing	0	2	1	25	25	50	-
8	CCA	26HS02PR0202 – 2 to 24	Liberal/Performing Art Lab	0	2	1	25	25	50	-
			TOTAL	**16**	**10**	**21**				

Liberal/Performing Art Lab		
Sr. No.	**Course Code**	**Course Name**
1.	26HS02PR0202-02	Fundamentals of Indian Classical Dance: Bharatnatayam
2.	26HS02PR0202-03	Fundamentals of Indian Classical Dance: Kathak
3.	26HS02PR0202-04	Introduction to Digital Photography
4.	26HS02PR0202-05	Introduction to Basic Japanese Language
5.	26HS02PR0202-06	Art of Theatre
6.	26HS02PR0202-07	Introduction to French Language
7.	26HS02PR0202-08	Introduction to Spanish Language
8.	26HS02PR0202-09	Art of Painting
9.	26HS02PR0202-10	Art of Drawing
10.	26HS02PR0202-11	Nature camp
11.	26HS02PR0202-12	Developing Self Awareness
12.	26HS02PR0202-13	Art of Poetry
13.	26HS02PR0202-14	Creative and Content Writing
14.	26HS02PR0202-15	Science of Life through Bhagwad Gita
15.	26HS02PR0202-16	Sanskrit Sambhashan– Spoken Sanskrit
16.	26HS02PR0202-17	Kirtan Kala
17.	26HS02PR0202-18	Introduction to German Language and culture
18.	26HS02PR0202-19	Adventure Sports
19.	26HS02PR0202-20	Introduction to Defense Forces & Obstacle Training
20.	26HS02PR0202-21	First Aid & Disaster Management
21.	26HS02PR0202-22	Basic Nutritional Course
22.	26HS02PR0202-23	Stress Management Through Yoga & Meditation
23.	26HS02PR0202-24	Audio Recording & Dubbing
24.	26HS02PR0202-25	Art of Basic Film Making

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 Name	Hours/week		Credits	Maximum Marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PCC	26EE05TP0301	Analog and Digital Communication	3	2	4	50+25	50+25	100+50	3
2	PCC	26EE05TH0302	Electromagnetic Fields	2	0	2	50	50	100	2
3	PCC	26EE05TP0303	Microcontrollers & Peripherals	3	2	4	50+25	50+25	100+50	3
4	OE	26EEOEC05TH0304	Open Elective – 1/ MOOC	2	0	2	50	50	100	2
5	MDM	26EE05TH0305	MDM – 1	3	0	3	50	50	100	3
6	ESC	26EE05PR0306	Fundamentals of Linux	0	2	1	25	25	50	-
7	VSEC	26EE05TP0307	Foundation of Electronics Manufacturing Systems	1	2	2	50+25	25	50+50	-
8	VEC	26HS01TP0301	Environmental Science	1	2	2	50+25	25	50+50	-
			TOTAL	**15**	**10**	**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	26EE05TP0401	PCB Design	3	6	6	50+25	50+25	100+50	3
2	PCC	26EE05TP0402	Embedded Systems	3	2	4	50+25	50+25	100+50	3
3	PCC	26EE05TP0403	CMOS VLSI Design	3	2	4	50+25	50+25	100+50	3
4	ESC	26EE05TH0404	Database Management Systems	3	0	3	50	50	100	3
3	SEC	26EE05PR0405	Competitive Coding – I	0	2	1	25	25	50	-
5	OE	25EEOEC05TH0406	Open Elective – 2/ MOOC	2	0	2	50	50	100	2
6	MDM	26EE05TH0407	MDM – 2	3	0	3	50	50	100	3
7	AEC	26HS04PR0401	Self Defense and Indian Martial Arts	0	2	0	-	-	-	-
			TOTAL	**17**	**14**	**23**				

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	26EE05TP0501	Computer Communication Networks	3	2	4	50+25	50+25	100+50	3
2	VSEC	26EE05TP0502	SMT Assembly Line	3	6	6	50+25	50+25	100+50	3
3	PCC	26EE05TP0503	Digital Signal Processing	3	2	4	50+25	50+25	100+50	3
4	PEC	26EE05TP0504	Program Elective – 1	3	2	4	50	50	100	3
5	OE	26EEOEC05TP0505	Open Elective – 3	1	2	2	50+25	25	50+50	-
6	MDM	26EE05TH0506	MDM – 3	3	0	3	50	50	100	3
7	PRJ	26EE05TH0507	Project Phase – I	0	4	2	25	25	50	-
			TOTAL	**16**	**18**	**25**				

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	26EE05TH0601	Wireless Communication	3	0	3	50	50	100	3
2	PCC	26EE05TH0602	Probability Theory and Random Processes	3	0	3	50	50	100	3
3	PCC	26EE05TP0603	Electronic Product Compliance	3	6	6	50+25	50+25	100+50	3
4	PEC	26EE05TP0604	Program Elective – 2	3	2	4	50+25	50+25	100+50	3
5	SEC	26EE05PR0605	Competitive Coding – II	0	2	1	25	25	50	-
6	PRJ	26EE05PR0606	Project Phase – II	0	6	3	50	50	100	-
7	MDM	26EE05TH0607	MDM – 4	3	0	3	50	50	100	3
			TOTAL	**15**	**16**	**23**				

Exit option 3
(Additional 8 Credits)
Offline/Online (ESSC-India / NSQF skill) Course on – PC Hardware and Computer networking / Embedded system design IoTor similar course/ 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 Name	Hours/week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PCC	26EE05TH0701	5G and Next Generation Communication Systems	3	0	3	50	50	100	3
2	PCC	26EE05TP0702	Digital Image Processing	3	2	4	50+25	50+25	100+50	3
4	PEC	26EE05TP0703	Program Elective 3	3	2	4	50+25	50+25	100+50	3
5	PEC	26EE05TP0704	Program Elective 4	3	2	4	50+25	50+25	100+50	3
6	CEP	26EE05PR0705	*Participative Learning	0	2	1	25	25	50	-
7	PRJ	26EE05PR0706	BEST EMS Project	0	6	3	50	50	100	-
			TOTAL	**12**	**14**	**19**				

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	26EE05TH0801	Program Elective 5	3	0	3	50	50	100	3
2	PEC	26EE05TH0802	Program Elective 6	3	0	3	50	50	100	3
3	PRJ	26EE05PR0803	Capstone Project	0	12	6	50	50	100	-
			TOTAL	**6**	**12**	**12**				
OR										
4	INT	26EE05PR0804	Full Semester Internship	**0**	**24**	**12**	100	100	200	**-**

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	Course Name	Hours/week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PEC	26EE05TH0707	NPTEL/ Online Courses	3	0	3	50	50	100	-
2	PEC	26EE05TH0708	NPTEL/ Online Courses	4	0	4	50	50	100	-
3	INT	26EE05PR0805	Full Year Internship	0	48	24	200	200	400	-
			TOTAL			**31**				

Students are required to earn total **07 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	26EE05HT0301	Communication System Analysis	3	0	3	50	50	100	3
IV	26EE05HT0401	Multimedia Networks	3	0	3	50	50	100	3
V	26EE05HT0501	Advanced Digital Communication	4	0	4	50	50	100	3
VI	26EE05HT0601	Millimeter Wave Communication	4	0	4	50	50	100	3
VII	26EE05HP0701	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	26EE05HT0701	Research Methodology	3	0	3	50	50	100	3
VII	26EE05HP0702	Research Project Phase – I	0	6	3	50	50	100	-
VIII	26EE05HP0801	Research Project Phase – II	0	25	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	26EE05MT0301	Fundamentals of Communication Engineering	3	0	3	50	50	100	3
IV	26EE05MT0401	Sensors for Intelligent Instrumentation	3	0	3	50	50	100	3
V	26EE05MT0501	IoT for Industrial Application	4	0	4	50	50	100	3
VI	26EE05MT0601	Future Generation Networks	4	0	4	50	50	100	3
VII	26EE05MP0701	Project	0	8	4	50	50	100	3
		TOTAL	**14**	**8**	**18**				

List of Program Elective Courses (Domain Wise)

Semester	Domain Name		
	VLSI	**Embedded systems & Signal Processing**	**Communication & Networking**
V [PE1]	Digital System Design	Smart Sensors	Information Theory and Coding
VI [PE2]	Advanced Digital System Design	Internet of Things	Radiating Systems
VII [PE3& PE4]	System Verification	Computer Vision	Cryptography and Network Security
	SoC Design	Generative AI	Wireless Sensor Networks
VIII [PE5& PE6]	Design for Testability	RTOS and kernels	Cognitive Radio
	RF Circuit Design	Speech and Audio Processing	Microwave Theory and Techniques

Program Electives

Semester	Program Elective	Courses
V	**Program Elective – 1**	1. Digital System Design 2. Smart Sensors 3. Information Theory and Coding
VI	**Program Elective – 2**	1. Advanced Digital System Design 2. Internet of Things 3. Radiating Systems
VII	**Program Elective – 3**	1. System Verification 2. Computer Vision 3. Cryptography and Network Security
	Program Elective – 4	1. SoC Design 2. Generative AI 3. Wireless Sensor Networks
VIII	**Program Elective – 5**	1. Design for Testability 2. RTOS and kernels 3. Cognitive Radio
	Program Elective – 6	1. RF Circuit Design 4. Speech and Audio Processing 5. Microwave Theory and Techniques

Multi-Disciplinary Minor (MDM) tracks
offered by Department of Electronics and Communication Engineering
for the students other departments

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

Semester	MDM	Course	Course Code
III	MDM – 1	Sensors for IoT	26EE05TH0305-1
IV	MDM – 2	Microcontrollers and IoT Applications	26EE05TH0407-1
V	MDM – 3	IoT System Architecture	26EE05TH0506-1
VI	MDM – 4	Use Cases of IoT	26EE05TH0607-1

Multi Disciplinary Minor (MDM)
Track: Mobile Communication

Semester	MDM	Course	Course Code
III	MDM – 1	Fundamentals of Communication	26EE05TH0305-2
IV	MDM – 2	Cellular Communication	26EE05TH0407-2
V	MDM – 3	LTE Technologies	26EE05TH0506-2
VI	MDM – 4	5G and 6G Systems	26EE05TH0607-2

Multi Disciplinary Minor (MDM)
Track: Microelectronics

Semester	MDM	Course	Course Code
III	MDM – 1	Microelectronics Foundation	26EE05TH0305-3
IV	MDM – 2	Digital subsystem Design	26EE05TH0407-3
V	MDM – 3	ASIC Design	26EE05TH0506-3
VI	MDM – 4	Project	26EE05TH0607-3

Credit Distribution in the Scheme of B. Tech. (ECE)

Category		Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Sem VII	Sem VIII	Total Credits (Actual)	Total Credits (as per NEP)
Basic Science Course	**BSC/ESC**	08	03	--	--	--	--	--	--	**11**	14-18
Engineering Science course		05	04	01	03	--	--	--	--	**13**	12-16
Program Core Course (**PCC**)	Program courses	02	11	10	14	08	12	07	--	**64**	44-56
Program Elective Course (**PEC**)		--	--	--	--	04	04	08	06	**22**	20
Multidisciplinary minor (**MDM**)	Multi Disciplinary courses			03	03	03	03	--	--	**12**	12
Open Elective (**OE**) Other than a particular program		--	--	02	02	02	--	--	--	**06**	06
Vocational and skill enhancement course(**VSEC**)	Skill courses	--	--	02	01	06	01	--	--	**10**	08
Ability Enhancement course (**AEC -01, AEC-02**)	Humanities Social Science and Management (**HSSM**)	03	--	--	--	--	--	--	--	**03**	04
Entrepreneurship /Economics/Management Course		--		--	--	--	--	--	--	**--**	04
Indian Knowledge System (**IKS**)			01		--	--	--	--	--	**01**	02
Value Education Course(**VEC**)		01	--	02	--	--	--	--	--	**03**	04
Research Methodology	Experimental Learning Courses	--	--	--	--	--	--		--	**--**	04
Comm. Engg. Project (CEP)/Field Project (FP)		--	--	--	--	--	--	01	--	**01**	02
Project (**PRJ**)		--	--	--	--	02	03	03	06	**14**	04
Internship/OJT (**INT**)		--	--			--	--	--	12*	**12***	12
Co-curricular Courses(**CC**)	Liberal Learning Courses	--	02	--	--	--	--	--	--	**02**	04
Total Credits		**19**	**21**	**20**	**23**	**25**	**23**	**19**	**12**	**162**	**162**

MDM tracks <u>offered to the students of ECE</u> program by other departments:

List of Multidisciplinary Minor [MDM] Courses offered by Department of Computer Science and Engineering

[For <u>Electronics and Communication Engineering</u> Students]

Sr. No.	Sem	Course Code	Name of Course	Hours per week		Credits	Maximum Marks			ESE Duration Hrs
				L	P		Continuous Evaluation	End Sem Exam	Total	
1	III	26CS01TH0305-5	**Design and Analysis of Algorithms**	3	0	3	50	50	100	3
2	IV	26CS01TH0407-5	**Artificial Intelligence**	3	0	3	50	50	100	3
3	V	26CS01TH0507-5	**Machine Learning**	3	0	3	50	50	100	3
4	VI	26CS01TH0605-5	**Deep Learning**	3	0	3	50	50	100	3
			TOTAL	**12**	**0**	**12**	**200**	**200**	**400**	

List of Multidisciplinary Minor [MDM] Courses offered by Department of Computer Science and Engineering

Sr. No.	Sem	Course Code	Name of Course	Hours per week		Credits	Maximum Marks			ESE Duration Hrs
				L	P		ContinuousEvaluation	End Sem Exam	Total	
1	III	26CS01TH0305-1	Introduction to Web Development	3	0	3	50	50	100	3
2	IV	26CS01TH0407-1	Front End Development	3	0	3	50	50	100	3
3	V	26CS01TH0507-1	Backend Technologies	3	0	3	50	50	100	3
4	VI	26CS01TH0605-1	Cloud Technologies	3	0	3	50	50	100	3
			TOTAL	**12**	**0**	**12**	**200**	**200**	**400**	

Sr. No.	Sem	Course Code	Name of Course	Hours per week		Credits	Maximum Marks			ESE Duration Hrs
				L	P		Continuous Evaluation	End Sem Exam	Total	
1	III	26CS01TH0305-3	Introduction to Cloud Computing + Google Cloud Foundation Certificate	3	0	3	50	50	100	3
2	IV	26CS01TH0407-3	Data Analytics + Google Cloud Data Analytics Certificate	3	0	3	50	50	100	3
3	V	26CS01TH0507-3	Cloud Engineering +Google Cloud Engineer Certificate	3	0	3	50	50	100	3
4	VI	26CS01TH0605-3	Cloud Security Fundamentals + Google Cloud Cyber Security Certificate	3	0	3	50	50	100	3
			TOTAL	**12**	**0**	**12**	**200**	**200**	**400**	

Sr. No.	Sem	Course Code	Name of Course	Hours per week		Credits	Maximum Marks			ESE Duration Hrs
				L	P		Continuous Evaluation	End Sem Exam	Total	
1	III	26CS01TH0305-4	Fundamentals of Network Security	3	0	3	50	50	100	3
2	IV	26CS01TH0407-4	Applied Cyber Defence	3	0	3	50	50	100	3
3	V	26CS01TH0507-4	Modern Cloud Security Architecture	3	0	3	50	50	100	3
4	VI	26CS01TH0605-4	Digital Forensics	3	0	3	50	50	100	3
			TOTAL	**12**	**0**	**12**	**200**	**200**	**400**	

List of Multidisciplinary Minor [MDM] Courses offered by Department of Management Technology

MDM in Project Management

Sr. No.	Sem	Course Code	Name of Course	Hours per week		Credits	Maximum Marks			ESE Duration Hrs
				L	P		Continuous Evaluation	End Sem Exam	Total	
1	III	26SM05TH0301	Introduction to Engineering Project Management	3	-	3	50	50	100	3
2	IV	26SM05TH0401	Project Planning, Scheduling, and Cost Control	3	-	3	50	50	100	3
3	V	26SM05TH0501	Engineering Project Risk, Quality, and Leadership	3	-	3	50	50	100	3
4	VI	26SM05TH0601	Advanced Project Management & Capstone for Engineers	3	-	3	50	50	100	3
			TOTAL	**12**	**-**	**12**	**200**	**200**	**400**	

MDM in Human Resource Management [HRM]

Sr. No.	Sem	Course Code	Name of Course	Hours per week		Credits	Maximum Marks			ESE Duration Hrs
				L	P		Continuous Evaluation	End Sem Exam	Total	
1	III	26SM04TH0301	Organizational Behaviour	3	-	3	50	50	100	3
2	IV	26SM04TH0401	Introduction to HRM	3	-	3	50	50	100	3
3	V	26SM04TH0501	Talent Management	3	-	3	50	50	100	3
4	VI	26SM04TH0601	Strategic HR Analytics	3	-	3	50	50	100	3
			TOTAL	**12**	**-**	**12**	**200**	**200**	**400**	

MDM in Banking, Financial Services and Insurance [BFSI]

Sr. No.	Sem	Course Code	Name of Course	Hours per week		Credits	Maximum Marks			ESE Duration Hrs
				L	P		Continuous Evaluation	End Sem Exam	Total	
1	III	26SM02TH0301	Financial Reporting, Statements, and Analysis	3	-	3	50	50	100	3
2	IV	26SM02TH0401	Banking and Financial Services	3	-	3	50	50	100	3
3	V	26SM02TH0501	Insurance Management	3	-	3	50	50	100	3
4	VI	26SM02TH0601	Fintech	3	-	3	50	50	100	3
			TOTAL	**12**	**-**	**12**	**200**	**200**	**400**	

MDM in Entrepreneurship and Venture Development

Sr. No.	Sem	Course Code	Name of Course	Hours per week		Credits	Maximum Marks			ESE Duration Hrs
				L	P		Continuous Evaluation	End Sem Exam	Total	
1	III	26SM03TH0301	Foundations of Entrepreneurship and Venture Development	3	-	3	50	50	100	3
2	IV	26SM03TH0401	Innovation and Product Development	3	-	3	50	50	100	3
3	V	26SM03TH0501	Startup Finance & Business Strategy	3	-	3	50	50	100	3
4	VI	26SM03TH0601	Startup Sandbox		6	3	100	-	100	-
			TOTAL	**12**	**-**	**12**	**200**	**200**	**400**	

Multidisciplinary Minor [MDM] Course offered by Department of Civil Engineering

MDM in Civil Engineering for Sustainable Development

Sr. No.	Sem	Course Code	Course Title	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		ContinuousEval	End SemExam	Total	
1	III	26ES01TH0305	Fundamentals of Civil Infrastructure and Construction	3	0	0	3	50	50	100	3
2	IV	26ES01TH0404	Construction Materials and Technology	3	0	0	3	50	50	100	3
3	V	26ES01TH0506	Green Building Construction and Environmental Systems	3	0	0	3	50	50	100	3
4	VI	26ES01TH0607	Building Construction Methods and Management	3	0	0	3	50	50	100	3
			TOTAL	**12**	**0**	**0**	**12**				

List of Multidisciplinary Minor [MDM] Courses offered by Department of Electrical Engineering

MDM in Renewable Energy and E-mobility

S. No	Sem	Course Code	Course Name	L	P	C	Continuous Assessment	End Semester/ Internal Evaluation	Total	Duration of End Semester (Hrs)
1	III	26EE07TH0309	Introduction to Renewable Energy Sources	3	0	3	50	50	100	3
2	IV	26EE07TH0409	EV Architecture and Components	3	0	3	50	50	100	3
3	V	26EE07TH0509	Energy Storage Systems in E- Mobility	3	0	3	50	50	100	3
4	VI	26EE07TH0609	Autonomous Vehicle	3	0	3	50	50	100	3
			TOTAL	**12**	**00**	**12**	200	200	400	

MDM in Nuclear Systems

Sem	Department	Course Name	L	P	C	Continuous Assessment	End Semester/ Internal evaluation	Total	Duration of End Semester (Hrs)
III	Chemistry	Nuclear Concepts-I	3	0	3	50	50	100	3
IV	Physics	Nuclear Concepts-II	3	0	3	50	50	100	3
V	Electrical	Basics of Nuclear Measurements	3	0	3	50	50	100	3
VI	Physics	Nuclear Security and Safeguards	3	0	3	50	50	100	3
TOTAL			12	00	12	200	200	400	

List of Multidisciplinary Minor [MDM] Courses offered by Department of Mechanical Engineering

MDM in Defense Technology

S. No	Sem	Course Code	Course Name	L	P	C	Continuous Assessment	End Semester/ Internal Evaluation	Total	Duration of End Semester (Hrs)
1	III	26ES03TH0307-01	Defense Platform	3	0	3	50	50	100	3
2	IV	26ES03TH0407-01	Warfare System	3	0	3	50	50	100	3
3	V	26ES03TH0507-01	Weapon System	3	0	3	50	50	100	3
4	VI	26ES03TH0607-01	Self-Defense & Protection System	3	0	3	50	50	100	3
			TOTAL	**12**	**00**	**12**	200	200	400	

MDM in Robotics

S. No	Sem	Course Code	Course Name	L	P	C	Continuous Assessment	End Semester/ Internal Evaluation	Total	Duration of End Semester (Hrs)
1	III	26ES03TH0307-02	Fundamentals of Robotics	3	0	3	50	50	100	3
2	IV	26ES03TH0407-02	Kinematics of Robotics	3	0	3	50	50	100	3
3	V	26ES03TH0507-02	Mobile Robotics	3	0	3	50	50	100	3
4	VI	26ES03TH0607-02	Drone Technology	3	0	3	50	50	100	3
			TOTAL	**12**	**00**	**12**	200	200	400	

MDM in AI Modelling & Simulation

S. No	Sem	Course Code	Course Name	L	P	C	Continuous Assessment	End Semester/ Internal Evaluation	Total	Duration of End Semester (Hrs)
1	III	26ES03TH0307-03	Foundations of AI Modelling	3	0	3	50	50	100	3
2	IV	26ES03TH0407-03	Machine Learning for Simulation	3	0	3	50	50	100	3
3	V	26ES03TH0507-03	Advanced Simulation Techniques	3	0	3	50	50	100	3
4	VI	26ES03TH0607-03	AI-Driven Simulation in Practice	3	0	3	50	50	100	3
			TOTAL	**12**	**00**	**12**	200	200	400	

I SEMESTER

SYLLABUS FOR Semester I

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

Course Code: 26HS03TP0104 **Course Name: Engineering Mathematics I**

L: 3 Hrs, P: 2 Hrs, Per week **Total Credits: 04**

Course Objective:

The objective of this course is to develop a strong foundation in differential equations, statistics, probability, and differential calculus, with a focus on their applications in Electronics and communication Engineering. The course integrates theoretical concepts with computational lab-based experiments to enhance students' ability to model, analyze, and solve engineering problems using mathematical and simulation tools.

Course Outcomes

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

1. Solve and analyze first-order ordinary differential equations and apply them to model real-life engineering problems using computational tools.
2. Formulate and solve higher-order differential equations using analytical techniques and interpret their applications through graphical models.
3. Analyze and interpret engineering data using curve fitting, regression, and correlation techniques to identify patterns and relationships.\
4. Apply differential calculus methods to solve engineering problems and use computational tools to model and optimize systems involving several variables.
5. Construct and solve partial differential equations related to engineering boundary value problems and simulate their behavior using computational visualization techniques.
6. Implement fundamental matrix operations to simulate and interpret applications in fields such as image processing, computer graphics.

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

Exact, linear and Bernoulli's equations, Euler's equations, Equations of first degree equations solvable for p, equations solvable for y, equations solvable for x and Clairaut'stype, Applications of First order Differential Equations.

Module 2:*Ordinary differential equations of higher orders* (7 hours)

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

Module 3: *Statistics:* (6 hours)

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

Module 4: Differential Calculus (8 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, Eulers Theorem, chain rule, total derivative, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers.

Module 5: Partial differential equations (PDE)(8 hours)
Introduction to PDE, solution of homogeneous PDE, solution of PDE with separation of variables, Applications of partial differential equations.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
3. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Volume I &II, Pune VidhyarthiGrihaPrakashan, Pune-411030 (India).
4. Paul Zimmermann, Computational Mathematics with Sagemath ,siam publisher

Lab Syllabus:

Exp. No.	Name of Experiments	Mapped COs
1	To use mathematical software as an advance calculator	**CO1**
2	Graphical Representation of 2D Functions Relevant to Engineering Models	**CO1,CO2, CO3**
3	3D Plotting Techniques for Visualizing ODE-related Engineering Models	**CO1,CO2, CO3**
4	Analyzing Data Trends through Curve Fitting Techniques	**CO3**
5	Visualization and Interpretation of Differential Equation Solutions	**CO1,CO2,CO5**
6	Differential Calculus Techniques for Modelling Engineering behavior.	**CO4**
7	Applied optimization (Maxima, minima and Gradient descent method)	**CO4**
8	Matrix Computations with various Applications	**CO6**

SYLLABUS FOR SEMESTER I

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

Course Code: 26HS05TP0102 **Course: Semiconductor Physics**

L: 3 Hrs. P: 2 Hrs. per week **Total Credits: 4**

Course Objectives:

1. To develop a fundamental understanding of electronic materials, energy band theory, and charge carrier behaviour in semiconductors.
2. To analyse the operation and characteristics of key semiconductor devices such as diodes, BJTs, and optical devices.
3. To apply semiconductor concepts to understand modern electronic and communication systems.

Course Outcomes

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

1. Explain the fundamental concepts governing electronic materials and their behavior.
2. Analyze the properties and behavior of charge carriers in semiconductor systems under different conditions.
3. Analyze the working principles and characteristics of diodes.
4. Explain the principles of optoelectronic systems and their applications in communication technologies.
5. Evaluate the performance of electronic devices for practical circuit applications.
6. Perform measurements using standard instruments and interpret experimental data using linear and non-linear graphs.

Unit 1: Electronic Materials and Energy Band Theory **7 Hrs.**

Formation of energy bands in solids, Classification of electronic materials: conductors, semiconductors, insulators, E–k (energy–wave vector) diagram and its significance, Direct and indirect band gap semiconductors, Valence and conduction bands, Density of states, Fermi–Dirac distribution function, Fermi level and its significance, Effective mass of charge carriers

Unit 2: Carrier Statistics and Semiconductor Fundamentals **7 Hrs.**

Intrinsic semiconductors and carrier concentration, Extrinsic semiconductors: n-type and p-type Dependence of Fermi level on carrier concentration and temperature, Graded &Step Graded semiconductor, Carrier generation and recombination mechanisms, Law of Mass action, Mobility and conductivity, Drift and Diffusion Current, Total current density equation,Continuity equation, Concept of carrier lifetime

Unit 3: Semiconductor Diodes **7 Hrs.**

Formation of p–n junction and depletion region, Biasing of p–n junction: zero bias, forward bias, reverse bias, Current–voltage characteristics of p–n junction diode, Zener diode: breakdown mechanism and characteristics, Tunnel diode: operation and negative resistance, Schottky diode: structure and characteristics

Unit 4: Optical sources and detectors **6 Hrs.**

LED, Hetero junction LED and its characteristics, LEDs for optical fiber communication, Interaction of matter and radiation, spontaneous and stimulated emission, metastable state, population inversion, Principle of LASER diode, Heterostructure LASER diode, Modes of the Laser, LASER diode characteristics, Applications of laser in Communications.

Unit 5: Bipolar Junction Transistors (BJT) **8 Hrs.**

Introduction to BJT and transistor action, Construction and operation of NPN and PNP transistors, Transistor configurations: Common Base (CB), Common Emitter (CE), Common Collector (CC), Input and output characteristics of BJT, Current relations and transistor parameters (α, β, γ)

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 Hall2001

Reference Books:

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.

List of Experiments:

1. Basic Measurements
2. Parameter extraction from V-I characteristics of a diode
3. Resistivity measurement of semiconductor by Four Probe method
4. Performance and analysis of Hall Effect in semiconductor to determine the Hall coefficient and carrier concentration of the majority carriers in the given specimen
5. Estimation of energy gap in semiconductor
6. Error analysis of the data using Linear Least Square Fit (LLSF) method
7. Verification of Planck's constant.
8. Determination of wavelength of LASER light by diffraction grating
9. Input and Output Characteristics of transistor in Common Base (CB).
10. Input and Output Characteristics of transistor inCommon Emitter (CE)

References:

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: 26EE05TH0101 **Course: Network Theory**

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

Course Outcomes

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

1. Apply node and mesh analysis techniques to solve electrical networks.
2. Use standard network theorems for analysis of DC and AC circuits.
3. Analyze sinusoidal steady-state response, power relations, and transient behavior of RL, RC, and RLC circuits.
4. Solve network equations using Laplace transform.
5. Model two port electrical networks.

Module I:

Circuit Analysis and Network Transformations: Solution of resistive DC circuits, star-delta and delta-star transformation, source transformation, node analysis and mesh analysis of electrical networks, application of KCL and KVL, analysis of circuits containing voltage sources and current sources, basic treatment of dependent sources

Module II:

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

Module III:

Time-Domain and Frequency-Domain Analysis of Linear Circuits: Evaluation of initial conditions in RL, RC and RLC networks. Transient analysis of RL, RC and RLC circuits, evaluation of initial and final conditions, natural response and forced response. Laplace transform, inverse Laplace transform, partial fraction expansion, solution of network equations using Laplace transform, analysis of RL, RC and RLC circuits with and without initial conditions.

Module IV:

Two-Port Networks: Linear two-port network parameters: impedance parameters, admittance parameters, transmission/ABCD parameters and hybrid parameters. Interconnection of two-port networks.

Text Books:

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

Reference Books:

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

Syllabus for Semester I

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

Course Code:26EE05TP0102 **Course: Fundamentals of Programming**
L:4Hrs, P: 2 Hrs. Per week **Total Credits: 05**

Course outcomes

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

1. Apply fundamental programming concepts.
2. Analyze and design solutions using advanced data structures.
3. Evaluate and Optimize Program Performance Through Algorithmic Techniques.
4. Design and develop object-oriented solutions using C++

UNIT 1:

Fundamentals of C Programming : Introduction to Programming and C Language, Algorithm building , Flowchart/Pseudo code with examples, Keywords, Comments, Header files, Data Types and Variables: Basic data types, Operators Arithmetic operators Relational and logical operator Assignment operators, Increment and decrement operators, Bitwise operators, Conditional (ternary) operator, Control Structures, Decision making like if, if-else, nested if-else, else-if ladder, Switch-case statement, Looping constructs like for, while, do-while, Nested loops, Break, continue.

UNIT 2:

Functions and Storage Classes: Introduction to functions and modular programming, Function declaration, definition, and calling, Function arguments and return values, Call by value and call by reference, Function prototypes, Library functions vs. user-defined functions, Recursion, Recursive vs. iterative approach, applications, Storage Classes types, Arrays, Introduction to arrays, One-dimensional arrays declaration, initialization, and accessing, Basic array operations.

UNIT 3:

Advanced Data Structure: Multidimensional Arrays, Two-dimensional arrays, Matrix operations, Multidimensional arrays, Passing arrays to functions, Strings, String declaration and initialization, String manipulation functions, Array of strings, Pointers, Introduction to pointers and memory addressing, Pointer declaration and initialization, Pointer operators, Pointer to pointer, Structures, Introduction to structures, Structure declaration and initialization, Accessing structure members, Array of structures, Structures and functions, Nested structures, Pointers to structures

UNIT 4:

Introduction to C++ and Object-Oriented Programming : Basics of C++, Evolution of C++ and comparison with C, Object-oriented programming concepts like encapsulation, abstraction, polymorphism and inheritance, Structure of a C++ program, Reference variables and const keyword, Introduction to classes and objects, Class declaration and definition Access specifiers, Member functions and data members, Creating and accessing objects,

Constructors, this pointer, Operator Overloading, Inheritance, Types of inheritance, Base class and derived class, Access control in inheritance, Constructor and destructor in derived classes.

UNIT 5:
Problem-Solving and Practice: Introduction to Problem-Solving, Overview of LeetCode Platform, hands-on problem-solving, problempractice set.

References and Resources:

Textbooks for C Programming:

1. Kernighan, B. W., & Ritchie, D. M. (1988). The C Programming Language (2nd ed.). Prentice Hall.
2. Balagurusamy, E. (2019). Programming in ANSI C (8th ed.). McGraw Hill Education.
3. Kanetkar, Y. (2020). Let Us C (17th ed.). BPB Publications.

Textbooks for C++ Programming:

4. Balagurusamy, E. (2017). Object-Oriented Programming with C++ (7th ed.). McGraw Hill Education.
5. Lafore, R. (2002). Object-Oriented Programming in C++ (4th ed.). Pearson Education.
6. Stroustrup, B. (2013). The C++ Programming Language (4th ed.). Addison-Wesley.

Online Resources for Problem Solving:

7. LeetCode Platform - https://leetcode.com/
8. GeeksforGeeks - Data Structures and Algorithms tutorials
9. HackerRank - Programming challenges and competitions

Reference Books:

1. Gottfried, B. S. (2010). Programming with C (3rd ed.). Tata McGraw Hill.
2. Forouzan, B. A., &Gilberg, R. F. (2007). Computer Science: A Structured Programming Approach Using C (3rd ed.). Cengage Learning.
3. Deitel, P., &Deitel, H. (2015). C: How to Program (8th ed.). Pearson.

Sr. No	EXP NO.	Practical List	CO Mapped
1	**1**	a) Execute C program to perform Arithmetic operations. b) Execute C program to check a condition using if else.	CO1
2	**2**	a) Execute C program to display Inverted Star pattern using nested for loop. b) Execute C program using while and do while loop.	CO1
3	**3**	Write recursive functions to a) Calculate factorial of a number b) Generate Fibonacci series	CO2
4	**4**	Execute C program to find Average of 'n' numbers using Arrays.	CO2
5	**5**	Execute C program for Sorting elements of an Array in Descending order.	CO2
6	**6**	Execute C program for Transpose of a given matrix.	CO2
7	**7**	Execute C program to find the Largest number in an array of Integers using Function.	CO3
8	**8**	Execute C program to search an element in an array using Linear search if the element is present then print its position also.	CO4
9	**9**	Execute c program to Sort an array of strings alphabetically.	CO3
10	**10**	Execute C program to print title of Book price and number of pages using pointer to Structure.	CO3
11	**11**	a) Execute C++ program for a bank account management system: Define a class Account with data members (account number, name, balance) and member functions (deposit, withdraw, display), b) Write C++ program to Implement constructors (default and parameterized) c) Execute C++ to Create a derived class Savings Account that inherits from Account and adds interest calculation,	CO4

Syllabus for Semester I

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

Course Code:26HS02TP0101 **Course: Foundations of Business English**
L: 2 Hrs, P: 2Hr, Per Week **Total Credits: 3**

Course Objectives

The course aims to develop foundational communication skills required for academic and professional success by enhancing students' competence in grammar, vocabulary, speaking, listening, reading, and writing. It also seeks to familiarize learners with workplace communication practices and emerging AI-assisted communication tools, thereby improving their employability and readiness for professional contexts.

Course outcomes:

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

1. Apply and demonstrate active listening techniques and grammatical rules to construct accurate, coherent, and contextually appropriate communication.
2. Analyse and apply verbal aptitude strategies, business vocabulary, and reading comprehension techniques to interpret written communication effectively.
3. Demonstrate and adapt public speaking techniques and professional etiquette to deliver structured and audience-centric oral communication in workplace scenarios.
4. Evaluate and apply employability communication strategies by actively participating in group discussions, mock interviews, and résumé-building exercises to meet professional standards.
5. Create and justify professional documents using appropriate formats and ethically integrate AI-assisted tools to enhance clarity, accuracy, and effectiveness in communication.

Unit-1: Listening Comprehension and Remedial Grammar **5 Hours**

Listening Comprehension: Active listening, Reasons for poor listening, Barriers to effective listening, Traits of a good listener, Note-making

Remedial Grammar: Common Errors in Indian English, Subject-verb agreement, Tenses

Unit-2: Structural Communication and Reading Comprehension **5 Hours**

Verbal Aptitude: Para-jumbles, Analogies, Sentence completion, Syllogisms

Business Vocabulary: Use of power verbs, power adjectives and power adverbs, Common technical affixes, Avoiding corporate jargons

Reading Comprehension: Types and Strategies

Unit -3: Speaking Skills **5 Hours**

Public Speaking: Mechanics of Public Speaking, Five-C model of storytelling (audience-centric), principles of effective introductions and welcome addresses, and questioning techniques.

Professional Oral Communication: Meetings, Seeking and giving feedback,

Professional Etiquette: greetings, introductions, politeness strategies, telephone and virtual communication

Unit -4: Communication for Employment **5 Hours**

Group Discussions: concepts, types, roles, and evaluation parameters

Résumé Building: structure, content, and formatting techniques

Introduction to Interview Skills: types of interviews, commonly asked questions, and response strategies

Unit-5: Professional Communication **6 Hours**

Principles of professional document design

Academic and professional email writing (format, tone, etiquette)

Instruction writing (clarity, sequencing, audience awareness)

Statement of Purpose (SOP): structure and content

Introduction to AI-assisted communication (AI prompts and applications) and Ethical considerations in the use of AI in professional communication

Books

1. *Communication Skills*. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
2. *Practical English Usage*. Michael Swan. OUP. 1995.
3. *Remedial English Grammar*. F.T. Wood. Macmillan.2007
4. *On Writing Well*. William Zinsser. Harper Resource Book. 2001
5. *Study Writing*. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. *The AI Prompt Handbook for Business Writing: 50+ Prompts for Professionals, Managers & Entrepreneurs (The AI Prompt Handbook Series)*, Maxwell Striling, 2026

Foundations of Business English Lab

List of practicals

Computer Assisted + Activity Based Language Learning

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

Practical 2: Reading Skills

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

Practical 4: Pronunciation, Intonation, Stress, and Rhythm

Activity Based Language Learning

Practical 5: Public Speaking

Practical 6: Presentation Skills: Orientation

Practical 7: Presentation Skills: Mock

Practical 8: Group Discussions: Practice

Practical 9: Group Discussions: Mock

Reference Books

1. *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press.
2. *Practical English Usage.* Michael Swan. OUP. 1995.

Syllabus for Semester I,

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

Course Code:26HS02TH0103 – 2 **Course: Foundational course in Universal Human Value**

L: 1 HrsP: 0 Hr, Per Week **Total Credits: 1**

Course Objectives:

To help the students in holistic development and maintaining harmony at all the levels of a human being, i.e. individual, family, society and nature/existence.

Course outcomes:

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

1. Understand value education in life and implement self-exploration.
2. Create an in-depthunderstanding of harmony within a human being.
3. Understand and implement values to maintain harmony in a family.
4. Understand and implement values to maintain harmony in a society
5. Understand and implement values to maintain harmony in nature/existence and develop a holistic perspective of life.

Unit 1:- Course Introduction - Understanding Value Education **4 hours**

1.Meaning of Value Education
2.Need of value education, guidelines and content of value education.
3.Exploring our aspirations and concerns: Self-exploration (Content and process of self-exploration)
4. Basic human aspirations: Continuous happiness and prosperity
5. Role of UHV; Strengthening of self-reflection.

Unit 2:-Understanding Harmony in Human Being **3 hours**

1.Harmony of the self and the body.
   a. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
   b. Understanding the needs of Self ('I') and 'Body' .
   c. Understanding the activities of Self ('I') and 'Body'
   d. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).
2. Programs to ensure Sanyam and Health.

Unit 3:-Understanding Harmony in the Family: Harmony in Human-Human Relationship 3 hours

1. Understanding values in human-human relationship:
   a. Trust as the foundational value of a relationship and respect in a family
   b. Ensuring health of family and friends by implementing values
   c. Understanding the meaning of trust;
   d. Difference between intention and competence

e. Understanding the meaning of respect,
f. Difference between respect and differentiation

UNIT 4: Understanding harmony in the society: Harmony in Human-Human Relationship 2 hours

1. Understanding harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust)
2. Visualizing a universal harmonious order in society: Undivided Society, Universal Order-from family to world family.

UNIT 5:Understanding Harmony in Nature and Existence: 3 hours

1. Understanding harmony in Nature
2. Interconnectedness and mutual fulfilment among the four orders of Nature
3. Holistic perception of harmony at all the levels of existence

Text Books

1. A Foundation Course in Human Values and Professional Ethics, R.R Gaur, R Athana, G.P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019, ISBN 948-93-87034-47-1
2. A Textbook on Professional Ethics and Human Values by R S Naagarazan, New Age International Private Limited; First edition, 2020.

II SEMESTER

B. Tech Semester II

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

Course Code: 26HS03TH0214 **Course Name: Engineering Mathematics II**

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

Course Objective:

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

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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
2. Evaluate definite and improper integrals using Beta, Gamma functions, and trace the 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. Interpret the geometrical meaning of gradient, curl and divergence.
5. Perform line, surface and volume integrals of vector-valued functions.

Module 1: Linear Algebra*:* (7hours)

Rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Orthogonal transformation and quadratic to canonical forms, Introduction to n-dimensional space, Singular value decomposition and its application in reducing the dimensionality of images and data .

Module 2: Integral *Calculus:* (7 hours)

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

Module 3: ***Multiple Integrals*** (8 hours)

Multiple Integration: Double and triple integrals (Cartesian and polar), change of order ofintegration in double integrals, Change of variables (Cartesian to polar), Applications: area, massand volume by double integration, Center of mass and Gravity (basic concepts).

Module 4: Vector Calculus (Differentiation) (7hours)

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

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

Vector integration: Line integrals, work done, conservative fields, surface integrals andvolume 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.

Text Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition,2000.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &Sons, 2006.

Reference Books:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Volume I & II, Pune VidhyarthiGrihaPrakashan, Pune-411030 (India).

Syllabus for Semester II,

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

Course Code:26EE05TP0201	**Course: Electronic Devices and Circuits**
L: 3 Hrs, P: 2 Hrs. Per week	**Total Credits: 04**

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 the fundamentals of biasing circuits & MOSFET.
2. Understand differential amplifier & basics of op-amp.
3. Analyze small-signal models amplifier circuits & feedback topologies.
4. Estimate the performance parameters of linear & non-linear op-amp applications.
5. Design active filters, stabilized sinusoidal oscillators and timer circuits.

Unit 1: Fundamentals of Biasing and MOSFET

Need for biasing, DC and AC load lines, Operating Point (Q-Point). MOS Technology Fundamentals: MOS capacitor structure, channel formation, threshold voltage, Enhancement vs. Depletion MOSFETs. Output and Transfer characteristics

Unit 2: Small-Signal Analysis & Feedback Amplifiers

Small-signal model for MOSFETs. Low-frequency response of Common Source (CS) amplifier and Source Follower (Common Drain). Feedback: Basic concept, types of feedback, feedback topologies. Effects of negative feedback on gain, bandwidth, and stability.

Unit 3: Differential Amplifiers & Op-Amp Basics

Introduction to Differential Amplifiers, Current mirror circuits as active loads and current sources. Op-Amp Architecture: Internal block diagram, characteristics of ideal vs. practical Operational Amplifiers.

Unit 4: Linear & Non Linear Op-Amp Circuits

Inverting, non-inverting, adder, subtractor, integrator, differentiator, log and antilog amplifiers, instrumentation amplifiers, Precision Rectifiers, comparator, Schmitt triggers.

Unit 5: Other applications of Op-Amp

Sinusoidal Oscillators: R-C phase shift & Wein bridge type, Active Filters: low pass and high pass type, IC 555: block diagram, astable and monostable mode of operation.

Text Books:

1. Fundamentals of Microelectronics- Behzad Razavi, 2nd Edition, Wiley India Pvt. Ltd.
2. Integrated Electronics: Jacob Millman , Christos Halkias, Chetan Parikh, Second Edition,TMH.
3. Linear Integrated Circuits: D. *Roy Choudhary, Shail Jain, New Age International*.
4. OP-AMPS and Linear Integrated Circuits: *Ramakant Gaikwad, PHI*

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. **S**olid State Electronic Devices: Ben G Streetman, Sanjay Kumar Banerjee, Sixth Edition, PHI.
5. An Introduction to semiconductor Devices: Donald Nemen, Tata-McGraw Hill
6. Operational Amplifiers Design & Applications: *Tobey Graeme, Huelsman, McGraw hill*
7. Design with Operational Amplifiers and Analog Integrated Circuits: *Sergio Franco, TMH, 3rd Edition*
8. Operational Amplifiers: *G. B. Clayton, International Edition*
9. Operational Amplifiers and Linear Integrated Circuits: *Coughlin Driscoll, PHI, 4th Edition.*
10. Analog Filter Design: *M. E. Van Valkenburg ,PHI*.
11. Op-Amps and linear ICs*: Fiore J. M, Thomson Delmar learning.*
12. Analog Integrated Circuit Design : *David Johns, Ken Martin*

Experiment List: Electronic Devices and Circuits

SN	Name of Expt.	CO
1.	Identification of Electronic Components and study of basic electronic equipments such as CRO, Function Generator, Regulated DC power supply, Multi-meter, Breadboard etc.	
2.	Plot DC load line for a transistor in CE configuration and determine Q-point.	CO1
3.	Plot Transconductance and Drain characteristics of FET and estimate the performance parameters.	CO1
4.	Develop the small-signal model of a MOSFET and estimate parameters such as g_m and r_o from measured characteristics.	CO3
5.	Design & implement CS amplifier and estimate its voltage gain Av, input resistance Ri, and output resistance Ro.	CO3
6.	Implement a Source Follower circuit to verify Vout ≈ Vin	CO3
7.	Verify Inverting, Non-Inverting, and Summing amplifiers using op-amp.	CO2, CO4
8.	Analyze frequency response and wave-shaping for sine/square inputs for Integrator and Differentiator.	CO2, CO4
9.	Design a sinusoidal oscillator.	CO5
10.	Plot the frequency response of 1st order low pass Butterworth filter	CO5
11.	Generate square wave oscillations and timed pulses using IC timer 555; verify duty cycle equations.	CO5

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

Course Code: 26EE05TP0202 **Course: Data Structures and Algorithms**

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. 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 memoryallocation.
4. Demonstrate nonlinear data structures and their operations, such as trees and graphs.
5. Apply different searching, sorting, and hashing techniques for efficient dataorganization and retrieval.

UNIT-I: Data Structures and Algorithm Basics:
Introduction: Elementary data organizations and operations on it. Abstract data types (ADT) andtheir characteristics.
Algorithms: Characteristics, Asymptotic notations, time and space trade-offs, Analysis ofalgorithm.
Array ADT: Representations – row-major and column-major form, Dynamic Arrays,Implementation of Real-life problems using arrays.

UNIT-II: Stacks and Queues
Stack ADT: Stack implementation using arrays, Applications of stacks – expression conversionand evaluation, implementation of multiple stacks, Real life problem implementation using stacks.
Queue ADT: Queue implementation using arrays, Circular queue, Real life problemimplementation using Queue, introduction to double-ended queues and priority queues.

UNIT-III: Linked Lists
Singly Linked Lists (SLL): Creation of SLL, Operations on SLL: Insertion, Deletion, Traversal,reversal, ordering, etc., Linked representation of stacks and queues, Header node linked lists.
Doubly and Circular Linked Lists (DLL and CLL): Creation of Linked list and operations onit.

UNIT-IV: Trees and Graphs
Trees: Terminologies, Binary tree and operations, Binary search tree [BST] and operations,Threaded binary trees.
Self-balancing Search Trees: Tree rotations, AVL tree and operations, B tree, B+- tree andoperations.
Introduction to Graphs: Basic terminologies, representation of graphs, graph traversals: depthfirst search (DFS) and Breadth first search (BFS).

UNIT-V: Sorting and Searching
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.

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, SashuMogalla, 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; SecondEdition; PHI publication.
3. Thomas Cormen, Charles Leiserson, Ronald Rivest and Clifford Stein, Introduction toAlgorithms, Third Edition; Prentice Hall of India; 2009.

Experiment List – Data Structures and Algorithms

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

Syllabus for Semester II

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

Course Code: 26EE05TP0203 **Course: Digital Circuits**
L: 3 Hrs, P: 2Hr, Per Week **Total Credits: 4**

Course Outcomes
On completion of this course students will be able to:

1. Perform number system arithmetic and conversions
2. Implement Boolean equations using logic gates and PLDs.
3. Demonstrate the use of Verilog HDL to model digital circuits/systems
4. Design combinational circuits.
5. Design asynchronous and synchronous sequential circuits.

Module I:

Motivation for Digital Systems, Number Systems and Number Conversions. Arithmetic, Signed Number Representation, Digital Codes, Boolean Algebra & Theorems, SOP, POS Forms, Karnaugh Maps

Module II:

Introduction to Verilog, Modules and Ports, Modeling styles, Verilog syntax & constructs, Test benches and simulation, Timing and delays.

Module III:

Adders & Subtractors, Multiplexers & De-multiplexers, Encoders & Decoders, Code Converters, Comparators, Combinational circuit design.

Module IV:

Latches and Flip-Flops, Counters, Shift Registers, FSM, Sequential circuit design.

Module V:

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

Text Books:

1. Digital Logic and Computer Design: Morris Mano, PHI, 3rd Edition.
2. Stephen Brown and ZvonkoVranesic, “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. Modern Digital Electronics: R. P Jain, Tata McGraw Hill, 3rd Edition.

Experiment List – Digital Circuits

Experiment No.	Aim	CO Mapped
01	Verification of Truth Table of logic gates using Integrated Circuits.	CO1
02	Verify Boolean Laws using logic gate IC.	CO1
03	Design and implementation of simple combinational circuits using ICs	CO1
04	Design and Simulation of logic gates using various levels of abstraction of Verilog.	CO2,3
05	Implementing Digital Circuits using Verilog using various levels of abstraction.	CO2,3,4
06	Design and simulation of Combinational Digital Circuits.	CO2,3,4
07	Design and simulation of Flip-Flops using Verilog	CO2, CO3, CO4
08	Design and simulation of Sequential Digital Circuits using Verilog.	CO2,3,4
09	Study of implementing digital circuit on FPGA.	CO5

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

Course Code: 26EE05TH0204 **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.

Syllabus for Semester II

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

Course Code: 26HS02TH0203 – 1 **Course: Foundational Literature of Indian Civilization**
L: 1Hrs, P: 0 Hrs. Per week **Total Credits: 01**

Course Outcomes:

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

1. Understand the Indian knowledge system and its scientific approach
2. Get introduced to the Vedic corpus and recognize the multi-faceted nature of the knowledge contained in the Vedic corpus
3. Understand the salient features of the philosophical systems of the Vedic and non-Vedic schools
4. Develop an understanding about the foundation of Vedic Mathematics

Unit 1:

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

Unit 2:

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

Unit 3:

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

Unit 4:

Vedic Maths– 1: Introduction of Vedic Mathematics, Bodhyan geometry, circular functions, inverse circular functions.

Unit -5:

Vedic Maths – 2: Multiplication of polynomials by *nikhilaṃ* and *ūrdhvatiryagbhyām* sutra. Verification by *Gunitasamuccayaḥ*. Division of two polynomials using *parāvartyayojayet*.HCF and LCM of two polynomials using *ādyamādyenāntyamantyena*and*ānurūpyeṇa.* Factorization of polynomials up-to degree 3 using *ānurūpyeṇa*, *Lopanasthāpanābhyām*, *ādyamādyenāntyamantyena*.

Reference material

1. B. Mahadevan, Vinayak Rajat Bhar, Nagendra Pavana R. N., *"Introduction to Indian Knowledge System: Concepts and Applications"* PHI, 2022
2. S.C. Chatterjee and D.M. Datta, *An introduction to Indian Philosophy,* University of Calcutta, 1984

Syllabus for Semester II

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

Course Code: 26HS04PR0201 **Course: Health-Fitness-Wellbeing**

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:

CO1: (Imitation & Manipulation): Practice and perform general and specific fitness exercises and observe the fundamental skills of Sports,Games and basic Yogic exercises.
CO2: (Precision & Articulation): Demonstrate accuracy in measuring health & skill related fitness components and coordinate with the psychomotor skills to execute fundamental skills of Sports, GamesandYogicActivities.
CO3: (Naturalization): Design personal daily energy requirements and adapt health & fitness conscious habits for sustainable active lifestyle.

Course Content:
Unit 1:

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

Unit 2:

- Various Fitness Drills: walking, jogging, running, rope skipping, circuit training, interval training, fartlek training. etc.
- Yog: Standing, Sitting, Prone & Supine positions
- Suryanamaskar.
- Overall Wellness: Pranayama, Meditation and Relaxation Techniques.
- Practice of Recreational Games.
- Dietary Habits, Daily Energy Requirements.
- Practice of Fundamental Skills of Basketball, Football, Carrom, etc.
- Health related Physical Fitness Test.

References:

1. Uppal, A.K. (2023). Fitness, Wellness & Nutrition. New Delhi: Friends Publication.
2. Russell, R.P. (1994). Health and Fitness Through Physical Education. USA: Human Kinetics.
3. Kumar, Ajith. (1984) Yoga Pravesha. Bengaluru: RashtrothannaPrakashana.
4. 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.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
26HS02PR0202-02	**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 OfBharatnatayam).

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'sNatyasastra*, 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	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
26HS02PR0202-03	**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	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
26HS02PR0202-04	**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	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
26HS02PR0202-05	**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 Executend 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	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
26HS02PR0202-06	**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)
26HS02PR0202-07	**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 CivilisationFrançaises 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)
26HS02PR0202-08	**Introduction to Spanish Language**	I/II	2	1	50

Courseobjective:

TohelpbuildafoundationandinterestinSpanishlanguagesothatthestudentscanpursuethepr oficiencylevelsofthelanguagein highersemesters.

Courseoutcomes:

Onsuccessfulcompletionofthecoursethestudentswillbeabletoachievethefollowing:
CO1.DemonstratebasicknowledgeaboutSpain,thecultureandsimilarities/differencesbetweenIndi aandFrance
CO2.Learn to use simple language structures in everyday communication.CO3.Develop ability to write in basic Spanish about themselves and others.CO4.Developabilitytoreadandunderstandbeginnerleveltextsi nSpanish

Syllabus
ListofPracticals

Practical-1:OrientationaboutSpain,thelanguage,andculture
Practical-2:CommunicationSkills1:Vocabularybuildingforeverydayconversations
Practical-3: Practicesessions
Practical-4: ReadingandwritingSkills:ReadingandwritingsimpletextinSpanish
Practical-5: Practicesessions
Practical-6: CommunicationSkills2:listeningcomprehension
Practical-7: Practicesessions
Practical-8: WritingSkills:WritebasicSpanishandpractice

Recommendedreading

1. 15-MinuteSpanishbyAnaBremon
2. AulaInternacional1byJaimeCorpas,EvaGarcia,AgustinGarmendia.
3. ChicosChicasLibrodelAlumnobyMaríaÁngelesPalomino

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
26HS02PR0202-09	**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	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
26HS02PR0202-10	**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)
26HS02PR0202-11	**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 25 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)
26HS02PR0202-12	**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: NeurolinguisticProgramming , 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	Credi ts	Maximum Marks (Continuous Evaluation)
26HS02PR0202-13	**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)
26HS02PR0202-14	**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)
26HS02PR0202-15	**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)
26HS02PR0202-16	**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:

संस्कृतसम्भाषणशिबिरस्य पाठ्यक्रमः

प्रथमं 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।
- ऐक्यमत्रः।

द्वितीयं दिनम्

- गीतम्।
- पुनस्स्मारणम्।
- 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।
- ऐक्यमत्रः।

तृतीयं दिनम्

- गीतम्।
- पुनस्स्मारणम्।
- 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 - दद्मः। ददाति - ददति।
  शृणोमि – शृण्मः। 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।
- ऐक्यमत्यः।

चतुर्थं दिनम्

- गीतम्।
- पुनःस्मारणम्।
- 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. पुंलिङ्गे)।
  गतवती - पठितवती - लिखितवती (ए.व. स्त्रीलिङ्गे)।
  गतवन्तः - पठितवन्तः - लिखितवन्तः (ब.व. पुंलिङ्गे)।
  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, इत्यादयः।
- सङ्ख्या।
- समयः।
- ॐ – सङ्ख्याक्रीडा।
- कथा।
- सम्भाषणप्रदर्शनम्।
- चत्वारि वाक्यानि।
- सूचना।
- ऐक्यमत्यः।

पञ्चमं दिनम्

- गीतम्।
- पुनःस्मारणम्।
- वाहनानां नामानि।
- तृतीयाविभक्तिः - दण्डेन, मापिकया, लेखन्या, पुष्पेण।
  (वाक्यपत्रस्य आधारेण वाक्यानि वाचनीयानि।)
- सह, विना।
- अद्यतन, ह्यस्तन, श्वस्तन, पूर्वतन, इदानीन्तन
- भविष्यत्कालीनक्रियापदानां पाठनम्।
  गमिष्यति, पठिष्यति, लेखिष्यति।(कोष्ठकस्य साहाय्येन)
- गत,आगामि।
- गीतम्।
- स्म।
- अभवत्।
- क्त्वाप्रयोगः (कोष्ठकस्य साहाय्येन)।
- यदा – तदा।
- बन्धुवाचकशब्दाः।
- वेशभूषणानां नामानि।
- वर्णाः।
- रुचयः।
- क्रीडा - एकश्वासेन सङ्ख्याकथनम्।
- कथा।
- पञ्च वाक्यानि।
- सूचना।
- ऐक्यमत्यः।

षष्ठं दिनम्

- गीतम्।
- पुनःस्मारणम्।
- नूतनम् x पुरातनम्,
- बहु x किञ्चित्,
- दीर्घः x ह्रस्वः।
- उन्नतः x वामनः।
- 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 उत्तमं पुस्तकम्।
- इव। विनोदकणिका।(गतवान् 'इव' अभिनयं कृतवान्!)
- अपेक्षया।
- पशूनां नामानि।
- अवयवानां नामानि।
- वाक्यविस्तारणाभ्यासः।
  (सः मम पुस्तकं प्रातःकाले पञ्चवादने पठितवान्।)
- इतः पूर्वम् - इतः परम्।
- 'रामकृष्ण' सङ्ख्याक्रीडा।
- कथा।
- षट् वाक्यानि।
- सूचना।
- ऐक्यमत्यः।

सप्तमं दिनम्

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

दशमं दिनम्

- गीतम्।
- पुनःस्मारणम्।
- 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)
26HS02PR0202-17	**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
- टाळ, मृदंग, वीणा, तबला, पेटी या वाद्यांची ओळख.
- प्रवचनांसाठी अभ्यासग्रंथांचे मार्गदर्शन.
- वकृत्व 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)
26HS02PR0202-18	**Introduction to German Language and culture**	II	2	1	50

Course objective:

To help build a foundation and interest in German 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 Germany, the culture and similarities/differences between India and Germany
CO2. Learn to use simple language structures in everyday communication.
CO3. Develop ability to write in basic German about themselves and others.
CO4. Develop ability to read and understand beginner level texts in German.

Syllabus
List of Practicals

Practical-1: Orientation about Germany, the language, and culture
Practical-2: Vocabulary building for everyday conversations
Practical -3: Numbers, days and time
Practical-4: Introducing Oneself & Others
Practical-5: Reading Skills: Reading simple text in German language
Practical-6: Basic Verbs & Sentence Construction
Practical-7: Food & Dining, Giving Directions & Transportation
Practical-8: Writing Skills: Write basic German and practice

Recommended reading

1. German Made Easy by Diego A. Agundez
2. Teach Yourself Complete German: Learn to Read, write, Speak and Understand A new Language by
Paul Coggle, Heiner Schenke
3. Netzwerk A1 by Helen Smitz, Stefanie Dengler and Paul Rusch
4. Deutsche Welle (DW) – www.dw.com/learngerman
5. BBC Languages – German – www.bbc.co.uk/languages/german
6. Goethe-Institut – www.goethe.de

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
26HS02PR0202-19	**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:30 Hrs. Camp (2 Days and 1 Night)

Assessment Pattern:

Assessment Type	Weightage in Marks	Total Marks
Practical	Internal Marks – 25 Marks External Marks – 25 Marks	50
		Total – 50 Marks

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
26HS02PR0202-20	**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.

Assessment Pattern:

Assessment Type	Weightage in Marks	Total Marks
Practical	Internal Marks – 25 Marks External Marks – 25 Marks	50
		Total – 50 Marks

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
26HS02PR0202-21	**First Aid & Disaster Management**	II	0	1	50

Course Objective:

- Understand Disaster Types and Characteristics
- Learn Risk Assessment and Management
- Master Emergency Preparedness and Response
- Explore Recovery and Reconstruction
- Develop Skills in Communication and Coordination
- Understand Legal and Ethical Considerations

Course Outcome:

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

- Identify and Categorize Disasters
- Conduct Risk Assessments
- Develop Emergency Plans
- Implement Response Strategies

Syllabus:

- Basic First Aid
- Transportation of Casualty
- Injury Prevention & Cure
- Various Types of Knots & Hitches
- Various team building activities
- Fire emergencies & use of extinguishers (Optional)
- Snake Bite & Environmental emergencies.

Assessment Pattern:

Assessment Type	Weightage in Marks	Total Marks
Practical	Internal Marks – 25 Marks External Marks – 25 Marks	50
		Total – 50 Marks

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
26HS02PR0202-22	**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,
- 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.

Assessment Pattern:

Assessment Type	Weightage in Marks	Total Marks
Practical	Internal Marks – 25 Marks External Marks – 25 Marks	50
		Total – 50 Marks

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
26HS02PR0202-23	**Stress Management Through Yoga & Meditation**	II	0	1	50

Course Objective:
Mental health is one of the most important facets of human life. Academic learning has emerged as a major source of stress among young students worldwide. Promoting mental well-being among students in India is a crucial step toward achieving Sustainable Development Goal 3 (Good Health and Well-being). Stress management involves using various techniques and strategies to control stress levels, improve how you react to stressful situations. Yoga combines physical movement with deep breathing and meditation, providing a holistic approach to stress relief.

Course Outcome:
Upon successful completion of the course, students should be able to:
- Understand the basics of stress management.
- Analyze stress triggers and to manage them.
- Evaluate the responses to stressful situations.
- Apply the techniques of Yog& Meditation for stress management in day-to-day life.

Syllabus:

Unit-1
Introduction to Stress: The Meaning of Stress, types of stress: distress, eustress
Stress Management Techniques I:
Treatment 1- (Asanas): Tadasana, Trikonasana, Vrikshasana, Garudasana,,Ardha-Padamasana, Padamasana, Vajarasana, Ushtrasana, Gomukhasna,, Paschimottanasan, ,ArdhaHalasana, ,Setu-Bandhanasa,Naukasana, Bhujangasana, and Dhanurasana; along with relaxing asanas

Unit-2
Spiritual approach to stress management.
Stress Management Techniques II
Treatment 2 – (Prananyam) Deep breathing, Yoga, Mindfulness meditation
Rechak, Purak, Kumbhak, NadiSuddhi and Bhramari Pranayama.
Measuring Academic stress- It can be measure using questionnaire: Academic stress Scale (Sun .et al 2011**).**

Assessment Pattern:

Assessment Type	Weightage in Marks	Total Marks
Practical	Internal Marks – 25 Marks External Marks – 25 Marks	50
		Total – 50 Marks

Syllabus for Semester II

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
26HS02PR0202-24	**Audio Recording & Dubbing**	II	2	1	50

Course delivery: VMV Commerce, JMT Arts & JJP Science, B.Voc. Department

Course Outcomes:

1. Develop a Comprehensive Understanding of Audio in Content Creation
2. Equip students with in-depth knowledge of the role, benefits, and applications of audio in enhancing digital content across various platforms.
3. Design and Implement a Personalized Audio Setup. Enable students to build and optimize their own audio recording setups tailored for platforms such as YouTube, Instagram, podcasts, and other digital media outlets.
4. Enhance Presentation and Marketing Skills Through Audio Integration. Demonstrate how high-quality audio contributes to effective communication, audience engagement, and brand marketing in both professional presentations and promotional content.

Syllabus:

Practical 1: Orientation in Sound and Basics of Audio
Practical 2: Orientation in Input and Output
Practical 3: Orientation in Audio Devices (Hardware & Software)
Practical 4: Audio Recording: Song, Voiceover, Dubbing
Practical 5: Audio Editing
Practical 6: Audio Session I
Practical 7: Audio Session II
Practical 8: Audio Session III

References books

1. Sound and Recording: Applications and Theory – Francis Rumsey & Tim McCormick (Focal Press)
2. Practical Recording Techniques – Bruce Bartlett & Jenny Bartlett (Routledge)
3. Mixing Audio: Concepts, Practices and Tools – RoeyIzhaki (Focal Press)
4. The Art of Sound Recording – David Moulton
5. Digital Audio Editing: Correcting and Enhancing Audio – Simon Langford (Focal Press)
6. Mixing Secrets for the Small Studio – Mike Senior (Focal Press)
7. The Mixing Engineer's Handbook – Bobby Owsinski (Hal Leonard)
8. Audio Engineering 101 – Tim Dittmar (Focal Press)

Syllabus for Semester II,

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
26HS02PR0202-25	**Art of Basic Film Making**	II	2	1	50

Course delivery: VMV Commerce, JMT Arts & JJP Science, B.Voc. Department

Course Objectives:
The course aims to introduce students to the fundamentals of filmmaking, nurturing creativity and technical understanding through hands-on practical sessions. Students will learn the visual language of cinema and explore storytelling through the medium of film.

Course Outcomes (COs)
On completion of the course, students will be able to:

1. Understand the basic concepts, history, and evolution of film as an art form.
2. Apply principles of visual storytelling, framing, and composition in short film projects.
3. Develop creative and technical skills related to camera handling, lighting, sound, and editing.
4. Work collaboratively to conceptualize, plan, shoot, and edit a short film, demonstrating teamwork, creativity, and problem-solving skills.

Syllabus:

- Practical 1 Introduction and Orientation to Film Making
- Practical 2 Basics of Visual Storytelling and Cinematic Language
- Practical 3 Camera Handling and Shot Composition
- Practical 4 Lighting and Sound Techniques
- Practical 5 Scripting and Storyboarding
- Practical 6 Shooting Exercises and On-Set Practice
- Practical 7 Basics of Editing and Post-Production
- Practical 8 Final Short Film Project and Screening

SEMESTER – III

Syllabus for Semester III,

B. Tech. (Electronics and Communication Engineering)

Course Code: 26EE05TP0301 **Course: Analog and Digital Communication**
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. Explain analog and digital modulation techniques
2. Demonstrate sampling, pulse modulation and multiplexing techniques
3. Analyze the effect of noise in communication system
4. Analyze digital modulation schemes
5. Measure the various parameters of analog and digital modulation techniques through experimentation

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

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, Voice coder (Vocoders)

Unit III

Line Coding, 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, PSK, DPSK, QPSK, QAM, Probability of Error evaluations for ASK, FSK, PSK, Optimum Filter, Matched Filter, Signal Space Analysis of Optimum Detection

Unit V

Spread Spectrum, Pseudo noise Sequences, Direct Sequence Spread Spectrum, Frequency hop Spread Spectrum, 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, 4thEdition , “ Electronics Communication systems ”

Experiment List – Analog and Digital Communication

LAB 1	a. Analyze the effects of variation in message/carrier signal amplitude and frequency during modulation for indices m = 1, m< 1 and m> 1 on amplitude modulated waveform for sinusoidal and triangular input message. (AM Transmitter). Receive the baseband signal from transmitter using amplitude modulation.(AM Receiver). b. Implementation and analysis AM using MATLAB and COMMSIM	CO1,CO5
LAB 2	a. Generation and Demodulation of FM wave, calculate modulation index for FM. b. Implementation and analysis FM using MATLAB and COMMSIM	CO1,CO5
LAB 3	a. To understand sampling and reconstruction and observe the sampling process with • Variation in sampling frequency • Variation in duty cycle • Change in order of LPF Analyze the effect of variation in each case and draw the conclusion b. Implement an analog signal sampling and reconstruction using MATLAB	CO2, CO3
LAB 4	a. Observation of PAM, PWM and PPM waveforms and it's demodulation and draw the corresponding time domain diagrams b. Implementation and analysis of PAM, PWM and PPM modulation and demodulation using MATLAB	CO2
LAB 5	a. Investigate the influence of varying sampling frequencies on Pulse Code Modulation (PCM). b. Implementation and analysis of PCM using MATLAB	CO2
LAB 6	a. Implement delta and adaptive delta modulation with the help of a trainer kit b. Implementation and analysis of DM/ADM using MATLAB	CO4
LAB 7	a. Examination of QPSK modulation behavior under different input bit sequences b. Implementation and analysis of QPSK modulation–demodulation using MATLAB	CO4
LAB 8	Implementation and analysis of different line coding techniques using MATLAB	CO4

Syllabus for Semester III,

B. Tech. (Electronics and Communication Engineering)

Course Code: 26EE05TH0302 **Course: Electromagnetic Fields**
L: 2 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 02**

Course outcomes

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

1. Visualize different coordinate systems to understand the spatial variations of the physical quantities dealt in electromagnetic field theory.
2. Understand static electric and magnetic fields, their behavior in different media, associated laws.
3. Apply Maxwell‘s equations for solutions of problems pertaining to uniform plane wave propagation
4. 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 and Magnetic Fields: Coulomb's law, Electric Field Intensity, Electric Flux Density, Gauss law, Biot-Savart’s law, Ampere’s circuital law, Magnetic Field due to infinitely long current carrying conductor.

Unit – III

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 – IV

Uniform Plane Waves: Electromagnetic wave equation, Propagation constant, attenuation constant, phase constant, 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 III, B. Tech. (Electronics and Communication Engineering)

Course Code: 26EE05TP0303 **Course: Microcontrollers and Peripherals**

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 organization of computer systems, instruction set architecture, and processor components.
2. Apply processor arithmetic algorithms and ALU design principles for understanding the need of microcontroller in regards to its Architecture and functional pin diagram.
3. Infer the programming needs of microcontrollers in terms of assembly language and embedded C.
4. Apply the knowledge of architecture and programming to interface various peripherals with microcontrollers
5. Analyze and simulate algorithms of microcontrollers in regards to the circuit requirement.

Unit I: Computer Organization and Instruction Set Architecture

Basic Structure of Computers, functional Units of a Computer, machine instructions and Programs. Types of Instructions, instruction Set Architecture (ISA), instruction Formats.Processor-Level Design, Processor Components, Processor Organization, Arithmetic Logic Unit (ALU) Design. Memory Organization (RAM, ROM) and Memory Management (Cache Memory, Associative Memory, Virtual Memory).

Unit II: Microprocessor Vs Microcontroller

Comparison of microprocessor and microcontroller in regards toarchitecture, pin diagram and memory organization.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 III: Assembly Language and Embedded C programming

Assembly Language, Stacks, Queues and Subroutines. 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 IV: Computer Architecture for Microcontroller Interfacing and Peripherals

System Organization, Input–Output Systems, Interrupts, Direct Memory Access (DMA) , Standard I/O Interfaces. Intel 8051 Counters and timers, serial data communication, input/output devices interfacing and application development with microcontroller using keyboards, LEDs, Seven Segment Display, LCD displays,Pulse measurements, D/A and A/D conversions, stepper motor.

Unit V: Advance Computer Organization

Parallel Processing Concepts, Instruction Pipelining, Forms of Parallel Processing,Interconnection Networks, RISC and CISC Architectures.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 Reentrancy and Thread Safety in Embedded Software Development.

Text Books:

1. "Computer Architecture and Organization", Hayes J. P, PHI, Second edition / Third edition
2. Muhammad Ali Mazidi& Janice GilliMazidi, R. D. Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.
3. Embedded MicrocomputerSystems, RealTime Interfacing –Jonathan W. Valvano – Brookes / Cole, 1999, Thomas Learning.

Reference Books:

1. "Computer System Architecture", M. M. Mano, Edition
2. "Structured Computer Organisation", A. S. Tanenbum, PHI, Third edition
3. Real Time Systems – Design for distributed Embedded Applications: Herma K. Kluwer Academic.
4. Operating Systems – A Design Oriented approach: Charles Crowley, McGraw Hill.
5. The 8051 Microcontroller – Architecture, Programming and Applications – Kenneth J. Ayala, West Publishing Company.

List of Experiments - Microcontrollers and Peripherals

1. Introduction to Keil software for 8**051microcontroller**and understand its Addressing modes.
2. To understand Data transfer:
   a. 10 bytes from BANK 0 to BANK 1 using register addressing mode.
   b. 10 bytes from BANK 0 to BANK 1 using direct addressing mode.
   c. 10 bytes from BANK 0 to BANK 1 using indirect addressing mode.
   d. To demonstrate data transfer from code memory to external data memory.
   e. To demonstrate data transfer of 10 bytes from BANK 0 to BANK 1 using embedded C.
   f. To demonstrate data transfer from code memory to external data memory using embedded C.
3. To understand Arithmetic and logical instructions:
   a. Addition/Subtraction of two 16 bit numbers
   b. Multiplication/Division.
   c. Find 2's complement of 10 BYTES of data.
   d. Conversion from packed BCD to unpacked BCD.
4. To understand branching/looping:
   a. To find the number of times a specific byte of data is repeated.
   b. To find the largest/smallest number from a group of 10 bytes of data using selection sort.
   c. To arrange 10 bytes of data in ascending/descending order using bubble sort.
   d. To find the number of times a specific byte of data is repeated using embedded C.
   e. To arrange data in ascending/descending order using embedded C.
5. To develop algorithms pertaining to software subroutine/timers:
   a. To generate a square wave of 20ms 50:50 duty cycle on Port 0.0 (Boolean pin P0.0) using Boolean instructions and software delay subroutine.
   b. To generate a square wave of 20ms 20:80 duty cycle on Port 0.0 (Boolean pin P0.0) using Boolean instructions and software delay subroutine.
   c. To demonstrate a user pattern generation on a complete port which changes after every second.
   d. To demonstrate mode 1 utilization of any timer of 8051 to generate a square wave.
   e. To demonstrate software delay using embedded C.
   f. To demonstrate timer based delay generation using embedded C.
6. To develop algorithms pertaining to device control:
   a. To demonstrate serial transmission/reception in 8051
   b. To demonstrate a pattern on LED array.
   c. To demonstrate a pattern of Seven segment display device.
   d. To demonstrate a string on 16x2 LCD device.
   e. To demonstrate motor control with the help of 8051.

Syllabus for Semester III,

B. Tech. (Electronics and Communication Engineering)

Course Code: 26EE05PR0306 **Course: Fundamentals of Linux**

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 write shell scripts
2. Create file systems and directories and operate them
3. Create processes background and foregroundby system calls
4. Create shared memory segments, pipes,message queues and 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) Execute Shell Program to print all .txt files and .c files.
   b) Execute Shell program to move a set of files to a specified directory.
   c) Execute Shell program to display all the users who are currently logged in after Specified time.
   d) Execute 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) Simulatenl command.
7. Executeprogram 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. Execute Socket program to print system date and time (Using TCP/IP).

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

Course Code: 26EE05TP0307 **Course: Foundation of Electronics Manufacturing Systems**

L: 1 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 02**

Course outcomes

1. Apply safety practices while working with electrical equipment
2. Acquire skills in conducting and analyzing safety tests
3. Identify and explain the functions of common electrical components
4. Utilize basic measurement instruments for electrical signal analysis
5. Utilize Data Acquisition Systems (DAQs) and software for sensor data capture and analysis

Unit 1: Unit & Measurements

Definition of Measurement, Units & Standards, Errors in Measurement

Unit 2: Electrical Earthing & Safety

Safety Practices in Electrical Work
Safety and Regulatory Requirements

Unit 3: Safety Standards

Earthing and Safety Standards
Instruments – Earth Resistance Tester, Insulation Tester
Personnel Protective Equipment (PPE) used in an Electrical Lab

Unit 4: Measuring Instruments

Basic Instruments: Multimeter - LCR Meter - Current Clamp Meter - Rogowski Coils – Non-Contact Tester

Unit 5: Specifications of Instruments

Major Specifications of Instruments such as DSO, Current Probe, High Voltage Isolation Probe - Function Generators - Power Supplies
Instruments used for Power Electronic Applications – True RMS Meter, Harmonic Analyzer, Power Quality Analyzer

Unit 6: High Voltage & High Frequency Instruments

Differential Voltage Measurement Methods – Isolated Voltage & Current Sensing Techniques
Design of Signal Conditioner Circuits and Signal Interfaces – Selection of Voltage and Current Sensing Devices and Techniques

LIST OF EXPERIMENTS: Foundation of Electronics Manufacturing Systems

Sr No	Experiment	Co
1	Basic measurements using digital vernier calipers and micrometer	4
2	Measurement of earth resistance	2
3	Measurement of insulation resistance	2
4	Measuring voltage, current, and resistance using multimeter & clamp meter	4
5	Measurement of RLC using LCR meter at various frequencies	5
6	Function generator exploration: generating different waveforms of different shape and amplitude	4
7	Signal measurement using DSO	4
8	High voltage and current measurement using isolation probe, current probe and DSO	1
9	Power measurement in AC & DC circuits using power quality analyser	4
10	Harmonic measurement using power quality analyze	4

Syllabus for Semester III

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

Course Code: 26HS01TP0301 **Course: Environmental Science**

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

Course Outcomes

After successful completion of this course, students will learn to;

1. Explain sustainability principles, climate change impacts, and environmental regulations, and analyze the role of data analytics in addressing global environmental challenges.
2. Apply concepts of green computing and circular economy to evaluate IT infrastructure, e-waste management, and emerging environmental impacts of modern technologies.
3. Apply chemical principles and analytical techniques to safely analyze solutions and environmental samples for sustainable resource management and public health.

Unit 1: Sustainability & Digital Transformation

Sustainability Engineering: Introduction to the five pillars of sustainability and the 17 UN Sustainable Development Goals (SDGs).

Climate Change & Big Data: The role of data analytics in predicting climate patterns and tracking carbon footprints, Ozone layer depletion, Global warming and Air pollution.

Environment-Related Legislation: Digital compliance, Carbon Credits, Carbon sink, carbon taxes, and international agreements like the Paris Accord in the context of IT industries.

Unit 2: Green Computing & Circular Economy

Green IT Infrastructure: Energy-efficient data centers, green networking, and "Sustainable AI" (reducing the carbon cost of training large models).

E-Waste & Circularity: Life cycle assessment (LCA) of hardware; "Right to Repair" movement, waste management, recycling and circular economy.

Emerging Threats: Environmental impact of mining materials for high-tech devices (Nano-materials& Micro-plastics).

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.

List of Experiments:

Any Eight Experiments from the following:

1) Safe Handling of Hazardous Chemicals for Sustainable Communities (Handling hazardous chemicals, MSDS, waste minimization, disposal) SDGs: 3, 12, 13
2) Preparation of Standard Solutions for Sustainable Water Chemistry (Preparation of molar/normal/percent solutions and concentration determination) SDGs: 4, 9
3) Statistical Analysis of Acid–Base Neutralization for Green Decision-Making (Neutralization of acid against base and graph preparation using software) SDGs: 4, 9, 12, 13
4) Copper Estimation from PCB E-Waste for Resource Recovery (Estimation of Copper ions from acid-digested PCB solution) SDGs: 12, 14
5) Chromium Estimation from E-Waste for Water and Health Safety (Estimation of Chromium ions from e-waste sample) SDGs: 3, 6, 12
6) Estimation of Fe (II) Ions from E-Waste Rust for Sustainable Resource Management (Fe (II) ions using 1,10-Phenanthroline method) SDGs: 12, 15, 3, 9
7) Analysis of Beverage Acidity for Consumer Health Safety and Sustainable Production Compliance (Aligns with SDG 3 & 12)
8) Determination and Computational Analysis of AQI Data for Indian Cities; SDG: 3, 11, 13, 9
9) Estimation of Dissolved Oxygen in Wastewater for Clean Water Sustainability; SDG: 3, 11, 14, 6
10) Data-Driven Modeling of Organic Pollutant Adsorption on Activated Charcoal for Sustainable Wastewater Treatment

Suggested Books/Reference 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.

SEMESTER – IV

Syllabus for Semester IV,

B. Tech. (Electronics and Communication Engineering)

Course Code: 26EE05TP0401 **Course: PCB DESIGN**

L: 3 Hrs, T: 0 Hr, P: 6 Hrs. Per week **Total Credits: 06**

Course outcomes

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

1. Interpret PCB design requirements
2. Perform a multilayer PCB design and generate Gerber files for fabrication
3. Generate BOM files for procurement
4. Incorporate Design for Manufacturing (DFM) constraints while performing PCB routing
5. Perform PCB design for low and high frequency circuits
6. Perform Post layout analysis for signal integrity
7. Incorporate EMC guidelines and IPC standards while performing PCB routing
8. Find the costing of procurement, fabrication and assembly

Unit –I: Types of Components & Packaging

Introduction to Electronic System Design & Manufacturing (ESDM)

Electronics Components - Types of Components - Package Type – Terminology

Unit – II: PCB Design Flow

PCB Design Flow - Types of PCB - Substrate Type - Schematic Creations – Footprint Creation & Assignment

Unit –III: PCB Routing

PCB Routing - Track Width Calculation - Component Placement Single-layer Design - Double Sided Design

Unit – IV: Signal Integrity

Design Rule Checking (DRC) - BOM Generation - Gerber File Generation & Verification

Unit –V: IPC Standards

Introduction to IPC Standards – IPC 2221 Standards for PCB Design - Restriction of Hazardous Substances (RoHS) & Waste Electrical and Electronic Equipment (WEEE) Compliance

PCB Design Guidelines for EMC Compliance

Guidelines for 4-layer PCB Design

List of Experiments: PCB DESIGN

Sr No	Experiment	CO
1	Creation of new project – Schematic - symbol – Footprint in Ki-CAD	1
2	PCB design requirement & constraints	1,4
3	Single layer PCB design of a flyback isolated DC-DC converter	2, 3
4	Double layer PCB design of boards to be used in Electric Vehicle (EV) drives, energy management systems, Heating, Ventilation, and Air Conditioning (HVAC) systems, embedded & other consumer electronic appliances	2,4
5	Double layer PCB design adhering to the EMC guidelines and IPC standards	2,4,7
6	Four-layer PCB design for a 1 MHz high power density resonant DC-DC converter, adhering to EMC guidelines and IPC standards	2,4,5,7
7	Four-layer PCB design for a 150 MHz microcontroller launchpad adhering to EMC compliance guidelines and IPC standards	2,5,6,7
8	Four-layer PCB design for Embedded / FPGA boards adhering to EMC compliance guidelines and IPC standards	2,5,6,7

Syllabus for Semester IV,

B. Tech. (Electronics and Communication Engineering)

Course Code: 26EE05TP0402 **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

9. Understand the evolution, exposure and tool chain utilized for ARM microcontrollers
10. Identify the programming needs of ARM cortex microcontroller in terms of architecture and programmers model
11. Apply the knowledge of architecture and develop the embedded C based programming skills required for microcontroller
12. Deploy and configure Embedded environment to demonstrate interfacing of peripherals.
13. 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 and clock configuration.

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

Course Code:26EE05TP0403 **Course: CMOS VLSI Design**

L: 3 Hrs, T: 0 Hr, P: 2Hrs. 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 SystemsPerspective,4th Edition,Pearson EducationIndia,2011.
2. J.Rabaey,DigitalIntegratedCircuits:ADesignPerspective,PrenticeHallIndia,1997.

Reference Books:

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

List of Experiments–CMOS VLSI Design

1. Evaluate the output characteristics for 1um (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 $\beta_n/\beta_p$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 III SEM,

B. Tech. (Electronics and Communication Engineering)

Course Code: 26EE05TH404 **Course: Database Management Systems**

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, Architecture and Applications
2. Explain various file organizations, indexing techniques and hashing.
3. Use Structured Query Language (SQL) for database creation and interaction.
4. Analyze query processing and optimization
5. Design a database system.

Unit I:
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. Fundamentals of database systems - Elmasiri, Navathe& Gupta, 4th Edition, Pearson Education.

Reference Books

1. Raghu Ramakrishnan and Johannes Gehrke; “Database Management Systems”; Third Edition; Tata McGraw Hill Publication, 2003.

2. C.J. Date; “Database in Depth – Relational Theory for Practitioners”; O`Reilly Media

Syllabus for Semester IV,

B. Tech. (Electronics and Communication Engineering)

Course Code: 26HS04PR0401	**Course: SELF DEFENCE & INDIAN MARTIAL ARTS**
L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week	**Total Credits: 00**

Course Objective

This course aims to equip students—particularly female students—with the foundational skills and knowledge of essential self-defense techniques and Bhartiya Yudhkala (Indian Martial Arts). By the end of the program, students will possess increased awareness, confidence, and practical ability to protect themselves in potentially dangerous situations.

Course Outcomes

CO1: Demonstrate situational awareness and psychological preparedness by identifying potential threats and responding appropriately in guided scenarios.
CO:2 Accurately target vulnerable body points during controlled practice and roleplay situations.
CO:3 Execute and coordinate ground defense and escape techniques effectively in simulated confrontations.
CO:4 Apply improvised weapon techniques and basic stick defense skills while following safety protocols and legal considerations.

Class Duration: 14 weeks (2 hours/week)
Mode of Instruction: In-person, practical, Practice and interactive sessions
Assessment: Satisfactory/Unsatisfactory based on participation, skill demonstration, and adherence to safetyprotocols.

Course Description

Self-Défense & Indian Martial Arts is a life skills training program aimed at enhancing personal safety,especially for young women. It combines traditional Indian martial arts with modern self-defensetechniques, focusing on physical fitness, mental resilience, and situational awareness.

Key Features:

- Real-life scenario-based training and escape techniques
- Use of everyday objects for defense
- Cultural insights into Indian martial arts
- Safe, structured learning environment

Weekly Schedule; Modules/Syllabus

Week	Module	Content
Week 1	Module 1 – Introduction	Overview of self-defense, importance, mindset training, and history of Indian martial arts.
Week 2	Module 1 – Introduction (contd.)	Basics of situational awareness and psychological preparedness.
Week 3	Module 2 – Targeting Weak Points	Anatomical knowledge for self-defense: eyes, nose, throat, groin, knees.
Week 4	Module 2 – Targeting Weak Points (contd.)	Practice and roleplay scenarios.
Week 5	Module 3 – Ground Défense	Techniques to defend and escape when on the ground.
Week 6	Module 3 – Ground Défense (contd.)	Partner practice and resistance drills.
Week 7	Module 4 – 20 Escape Techniques Through Indian Culture	Practical escape methods inspired by traditional Indian martial forms.
Week 8	Module 4 – 20 Escape Techniques (contd.)	Application in staged confrontation settings.
Week 9	Module 5 – Weapon of Opportunity	Training with improvised weapons: pen, keys, dupatta, bags, etc.
Week 10	Module 5 – Weapon of Opportunity (contd.)	Timing, precision, and legal considerations.
Week 11	Module 6 – Stick Rotation	Basics of stick (lathi/danda) handling and defence.
Week 12	Module 6 – Stick Rotation (contd.)	Practice with focus on flow, blocking, and disarming.

SEMESTER – V

Syllabus for Semester V,

B. Tech. (Electronics and Communication Engineering)

Course Code: 26EE05TP0501 **Course: Computer Communication Networks**

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 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

List of Experiments – Computer Communication Networks

1. Study Experiments:
   a) Study of Basic Network Commands (At least 10)
   b) Study of different IP Addressing Schemes
   c) Study of various networking devices
   d) Study of Cables and Connectors

Experiments based on Cisco Packet Tracer

2. Server Simulations:
   a) Simulation of a network consisting of PCs connected to HTTPservers using Packet Tracer.
   b) Simulation of a network consisting of PCs connected to DNS servers using Packet Tracer.
   c) Simulation of a network consisting of PCs connected to FTP server and configuring the server for a given user id and password using Packet Tracer.
   d) Simulation of a network consisting of PCs connected to DHCP server and assigning IP addresses to all the devices in the network through DHCP using Packet Tracer.
   e) Simulation of a network consisting of PCs connected to an Email server and send email to other devices in the network using Packet Tracer
3. Router Simulations
   a) Simulation of a network consisting of PCs of TWO different networks connected through ONE Router using Packet Tracer.
   b) Simulation of a network consisting of PCs of THREE different networks connected through TWORouters using Packet Tracer.
4. Command Line Interface Simulations
   a) Configuration of ROUTER through Command Line Interface
   b) Configuration of DHCP Service through Command Line Interface.
5. Configure a Wireless LAN using Cisco Packet Tracer
6. Subnetting using Cisco packet Tracer
7. Configuration of Static Routing using Cisco packet Tracer
8. Mini Project

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

Course Code:26EE05TP0502 **Course: SMT Assembly Line**

L: 3 Hrs, T: 0 Hr, P: 6 Hrs. Per week **Total Credits: 06**

Course outcomes

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

1. Develop Standard Operating Procedure (SOP) for the overall operation of SMT assembly line
2. Operate all the equipment in SMTA as per SOP
3. Program & execute a pick and place machine
4. Program and execute a SPI machine
5. Configure the reflow oven with the required temperature profile
6. Perform an entire SMT assembly process
7. Perform the functional test of a finished product

Unit I Overview of SMT Assembly Line

Introduction to SMT Assembly Plant

Unit II SOP of Equipment Used in SMT Assembly Line

Significance of PPE / Electrostatic Discharge (ESD) in Protected Environment

Unit III Programming of Pick & Place Machine

Function, Major Specifications and SOP of Equipment used in Assembly Line

Pick and Place Machine

Unit IV Operation of Stencil Printer, SPI, AXI & AOI

Semi-Automatic & Fully Automatic Stencil Printer

Auto Loader and Unloader, Conveyors

Solder Paste Inspection (SPI) Machine

Reflow Oven

Automatic Optical Inspection (AOI) System

Unit V Temperature Profile Configuration in Reflow oven

X-ray Machine

Wave Soldering Machine

Unit VI EHS in SMT Assembly Lineparameter variation, Control system components SMT Assembly Process Flow

Introduction to ISO 9001 Quality Management Systems: Functional Test and Quality Auditing Process

List of Experiments: SMT Assembly Line

Sr No	Experiment	Co
1	Study of SOP & operation of pick and place machine	
2	Execution of 10 component placement programs in a PCB using manual edit and importing coordinate files	
3	Programming & execution of pick & place machine	
4	Hands-on training on solder paste mixer – applying solder pate using stencil printer	
5	Programming solder paste inspection machine	
6	Configuring solder profile in reflow oven – visual inspection after each process	
7	Hands-on training in AOI	
8	Hands-on training in X-ray machine	
9	Hands-on training - Functional testing of finished product	
10	Introduction to quality control process flow in SMT assembly line	

Syllabus for Semester V,

B. Tech. (Electronics and Communication Engineering)

Course Code: 26EE05TP0503	**Course: Digital Signal Processing**
L: 3 Hrs, T: 0 Hr, P: 2Hrs. Per week	**Total Credits: 04**

Course outcomes

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

1. Understand DFT and FFT algorithms, filter design techniques, and digital signal processors.
2. Apply DFT and IDFT to signals and systems.
3. Design of digital filters for given specifications.
4. Realize digital structure in optimum form.
5. Implement digital signal processing applications with simulationtoolsandDSPs starter kit.

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.

Unit IV

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

Unit V

Introduction to Programmable Digital Signal Processors(P-DSP) Architecture, Some examples of DSP Processors, DSPs applications, 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. A Practical Approach to Digital Signal Processing - K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, New Age International, 2006/2009
4. 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.

Digital Signal Processing Lab

Sr. No.	Experiment Title	Course Outcome
1.	Explore Matlab user interface and study commands and review its documentation.	CO1
2.	Write Matlab script for generating discrete signals and its plot in continuous and discrete form.	CO1
3.	Find the DFT of and IDFT of given input signal and verify it using fft and ifftmatlab commands.	CO1, 2
4.	Implement circular convolution using DFT and IDFT with user function.	CO2,5
5.	Realize and optimize the structures for given LTI discrete-time systems in z-domain and verify its response y(n) for a test input x(n).	CO4,5
6.	Design Butterworth low-pass filter IIR filter for given specification and compare the improvement in filter response for same specifications with higher order.	CO3,5
7.	Design Chebyshev high-pass filter IIR filter for given specification and compare the improvement in filter response for same specifications with higher order.	CO3,5
8.	Design band-pass FIR filters using Bartlet and Hamming window functions.	CO3,5
9	Design band-stop FIR filters using Blackman and Kaiser window functions.	CO3,5
10.	Remove noise from sine wave implementing adaptive filter on DSP processorkitTMS320C6745.	CO5

Syllabus for Semester V,

B. Tech. (Electronics and Communication Engineering)

Course Code: 26EE05TH0504 – 1	**Course: Digital System Design (Program Elective – 1)**
L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week	**Total Credits: 03**

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

Course Code: 26EE05TH0504 – 2 **Course: Smart Sensors (Program Elective – 1)**

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

Course outcomes

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

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

Unit-I

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

Unit-II

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

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

Unit-III

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

Unit-IV

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

Unit- V

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Code: 26EE05TH0504 – 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. Information Theory, Coding and Cryptography , Ranjan Bose, 3rd Edition, McGraw Hill Education
2. Elements of Information Theory, Thomas M. Cover and Joy A. Thomas, 2nd Edition, Wiley-Interscience / John Wiley & Sons

Reference Books:

1. Information Theory and Reliable Communication, Robert G. Gallager , 1st Edition,John Wiley & Sons.
2. R.B. Ash, Information Theory, Prentice Hall, 1970.
3. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.
4. SimonHaykin, *Communication Systems* , 4 th edition, Wiley Publications, 2001.

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

Course Code: 26HS02TP0501 **Course: Business Communication**
(Open Elective – III)

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 communicationetiquette, 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

Syllabus for Semester V,

B. Tech. (Electronics and Communication Engineering)

Course Code: 26EE05PR0507 **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 version.
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 – VI

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

Course Code: 26EE05TH0601 **Course: Wireless Communication**
L: 3Hrs, T: 2Hr, 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 working principles of the mobile communication systems.
2. Interpret radio wave propagation models for wireless systems.
3. Comprehend modulation schemes and multiple access techniques for wireless environments.
4. Analyze mobile communication systems for improved performance
5. Explore next generation wireless systems

Unit – I:

The Cellular Concepts: Architecture of mobile communication systems, call processing, cellular concepts, Frequency reuse, channel assignment, Hand of strategies interference & system capacity, improving grade of service & capacity in cellular systems.

Unit – II:

Mobile Radio Propagation: Large scale path loss, free space propagation model, propagation effects such as reflection, diffraction, scattering, Link Budget Design using path loss models, Multipath fading

Unit – III:

Modulation Techniques and Multiple Access in Mobile Communication: Quadrature modulation methods, fundamentals of equalization, Diversity Techniques, Narrow band and Wide band systems, Space Division Multiple access and other hybrid multiple access techniques.

Unit – IV:

Wireless Systems: GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, Concept of spread spectrum, Architecture of IS-95 CDMA system, Performance of CDMA System, RAKE Receiver.

Unit –V:

Recent Trends in Wireless Communication: Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Adhoc Network, Features of OFDM, OFDMA, LTE, NOMA, MIMO, Massive MIMO

Text Books:

1. Wireless Communication – Principles and practice: T S. Rappaport, Prentice Hall PTR, 2nd edition, 2007
2. Mobile Communications – Design fundamentals: William C. Y. Lee, John Willey, 2nd Edition, 2010

Reference Books:

1. Wireless digital communication: KamiloFeher, Prentice Hall
2. Mobile Cellular Communication: W. C. Y. Lee, McGraw Hill
3. The Mobile Radio Propagation channel: J.D. Parson, Wiley, 2nd edition

Syllabus for Semester VI,

B. Tech. (Electronics and Communication Engineering)

Course Code: 26EE05TH0602 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 - Bernaulli's, Binomial, Poisson and Geometric. Standard Continuous Distributions - Uniform, Normal (Gaussian), Exponential. Interval Estimation, Markov and Chebyshev Inequalities.

Unit IV

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

convergence, convergence in Mean Square, convergence in Probability, convergence in Distribution.

Unit V

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

Text Books:

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

Reference Books:

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

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

Course Code: 26EE05TP0603 **Course: Electronic Product Compliance**

L: 3 Hrs, T: 0 Hr, P: 6 Hrs. Per week **Total Credits: 06**

Course outcomes

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

1. Understand the IEC standards
2. Draft the product specification document to meet product compliance
3. Design of solutions for a new product to meet product compliance
4. Perform compliance test
5. Perform Failure Mode Effect Analysis (FMEA) of the failed products in compliance test
6. Design of solutions to a failed product in a compliance test

Unit I Overview of New Product Development Cycle

Overview of New Product Development Cycle

Significance of Product Certification - Need for Pre-compliance Testing

Unit II Introduction to Standards

Introduction to Different Standards – IEC/IEEE/UL/MIL

Switching Surges & Harmonics - Source of Surges

IEC 61000-4-2, IEC 61000-4-4 and IEC 61000-4-5 Standards on ESD, Electric Fast Transients (EFT)

Surge - Protection Techniques Against Surge, EFT & ESD

Characteristics of Metal Oxide Varistors (MOV) - Selection of MOVs

Instruments used for Conducting Surge, EFT & ESD Test

Source of Harmonics – Types of Non-Linear loads

IEC 61000-3-2 Standard on Harmonics

Unit III Significance of Product Compliance

Harmonic Compliance Techniques - Passive and Active Power Filters - Concept of Power Factor Correction (PFC) Rectifiers

Instruments for Harmonic Measurement - True RMS meters – Power Quality (PQ) Analyzer

Unit IV EMI & EMC Standards and Compliance

Electro Magnetic Interference (EMI) & Electro Magnetic Compatibility (EMC)

Concepts of EMI – Emissions & Susceptibility

Unit V Compliance Test Procedure

Electromagnetic Field (EMF) Source & Coupling Paths – Types of Noise Coupling Paths

EMI Shielding Techniques – PCB Level Shielding – Grounding Concepts – Radiated Emission (RE) – Conducted Emission (CE) - Conducted Immunity (CI) - Radiated Immunity (RI)

Unit VI Design for EMI/EMC Compliance

IEC 61000-6 Series Standards on EMC

Test procedures for EMC –Transverse Electromagnetic (TEM) cell – Anechoic Chamber

Introduction to Network Analyzer and Spectrum Analyzer

List of Experiment: Electronic Product Compliance

Sr No	Experiment	Co
1	Configuration of combined wave generator for a given test requirement and perform surge and generate test report as per IEC 61000-4-4	
2	Configuration of combined wave generator for a given test requirement and perform EFT test and generate test report as per IEC 61000-4-5	
3	Configuration of combined wave generator for a given test requirement and perform ESD test for a given EUT and generate test report as per IEC 61000-4-2	
4	Design of MOV for a given EUT to comply with surge & EFT requirement	
5	Perform a harmonic compliance test for a given EUT using harmonic analyzer as per IEC 61000-3-2	
6	Design of harmonic mitigation solution for an EUT failed in harmonic compliance test	
7	Performance of radiated emission test for a given EUT as per IEC 61000-6-3	
8	Performance of conducted emissions test for a given EUT as per IEC 61000-6-4	
9	Performance of radiated immunity test for a given EUT as per IEC 61000-6-1	
10	Performance of conducted immunity test for a given EUT as per IEC 61000-6-2	
11	Design of EMC compliance solution for an EUT failed in RE, CE, RI & CI tests	

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

Course Code:26EE05TH0604 – 1 **Course: Advanced Digital System Design (Program Elective – 2)**

L: 3 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 04**

Course outcomes

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

1. Elaborate the fundamentals of SystemVerilog; its syntax and application.
2. Apply randomization techniques for generating test scenarios and checking them in hardware verification.
3. Learn the basics of UVM for building reusable and scalable verification environments.
4. Design combinational and sequential logic circuits in SystemVerilog.
5. Evaluate SystemVerilog design using testbenches, assertions and randomization.

Unit – 1

Introduction to SystemVerilog: Overview, Importance in hardware design and verification, Evolution of Verilog to SystemVerilog, Comparison between Verilog and SystemVerilog.

SystemVerilog Basics: Literals, Data Types, Operators, Arrays, Parameters, Keywords and Constructs, Modules and Ports.

Unit – 2

Procedural Statement and Flow Control: Blocking and Non-blocking assignment, General purpose and specialized procedural blocks, Loops, Break, Continue and Return Statements, Design using always, always_comb, Sensitivity List, Sequential Logic Design Using always_ff for flip-flops and latches, Modeling edge-triggered behavior, Synchronization.

Unit – 3

Combinational and Sequential Logic Design: Basic RTL Design, Combinational Logic Task and Functions.

Modeling Finite State Machines: State Machines in SystemVerilog.

Unit – 4

SystemVerilog for Verification: Testbench Structure in SystemVerilog, Testbench components: stimulus, response checking, and reporting, Assertions and Functional Coverage, Randomization.

Unit – 5

Introduction to UVM: UVM vs traditional testbenches, Basic UVM constructs & classes, design a basic test environment using UVM SystemVerilog verification features.

Text Books:

1) SystemVerilog for Design Second Edition: A Guide to Using SystemVerilog for Hardware Design and Modeling, *Stuart Sutherland, Simon Davidmann, Peter Flake 2nd edition 2006, publisher Springer-Verlag New York Inc.*

2) SystemVerilog for Verification: A Guide to Learning the Testbench Language Features, *Chris Spear, Greg Tumbush, 3rd ed. 2012, Springer*

Reference Books

1) A Practical Guide for SystemVerilogAssertions,*SrikanthVijayaraghavan and MeyyappanRamanathan, 2005 ed., Springer Verlag*
2) Digital Design and Computer Architecture: RISC-V Edition, *David Harris and Sarah Harris, Morgan Kaufmann Publishers In*
3) Verification Methodology Manual for SystemVerilog, *Janick Bergeron, Eduard Cerny, Alan Hunter, Andy Nightingale, Springer-Verlag New York Inc.*

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

Course Code: 26EE05TH0604 – 2 **Course: Internet of Things (Program Elective – 2)**

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

7. Understand the architectures, scope and example applications of IoT.
8. Explore the linux environment for SBC (Single Board Computer)
9. Use Python-based IDE and debug Python code on the SBC.
10. Interface sensors and actuators with IoT enabled SBC.
11. 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.*
1. Raspberry Pi User Guide, *Eben Upton and Gareth Halfacreee, John Wiley & Sons, 2016*

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

Course Code: 26EE05TH0604 – 3 **Course: Radiating Systems (Program Elective – 2)**

L: 3 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 04**

Course outcomes

At the end of this course students will be able to

1. Study guided wave propagation.
2. Understand transmission line-based systems and components
3. Compare various types of antennas and related technologies for different applications
4. Analyze radiation types and radiation characteristics of an antenna
5. Design of an antenna array

Unit I

Transmission Lines: Transmission line equations and their solutions. Transmission line parameters, Characteristic impedances, Propagation constant, Attenuation constant, Phase constant, Reflection coefficient and VSWR, Equivalent circuits of transmission lines, Open circuited and short-circuited lines.

Unit II

Waveguides: Waves between parallel planes, TE, TM, & TEM and their characteristics, Attenuation in parallel plane guides wave impedances, TE, TM waves and impossibility of TEM mode in Rectangular waveguide, group velocity, phase velocity, guide wavelength and wave impedances of waveguides

Unit III

Antenna Basics: Scalar and vector potentials, related potentials, field due to a current element, radiated resistance and power for field due to a dipole, Reciprocity theorem applied to antennas, Antenna terminology: Gain, Aperture, Radiation intensity, Directivity, Directive gain, Beam width, Radiation patterns, FBR, Antenna bandwidth.

Unit IV

Antenna Arrays: Concept of antenna arrays, Two element arrays and their directional characteristics, Linear array analysis, Broadside and end fire arrays, Principles of pattern multiplication & their application, Polynomial representation, Binomial arrays, Design of broadcast array for a specific pattern.

Unit V

Special Antennas: Travelling Wave Antenna, Yagi-Uda Arrays, Loop Antenna, Helical Antenna, Log-Periodic Antenna, Micro strip Patch Antenna, Parabolic reflectors, Lens antenna, folded dipole, Turnstile antenna, Horn antenna, Travelling wave antenna, Cassegrain antenna

Text Books

1. Electromagnetic Waves & Radiating Systems: Edward C. Jordan, Keith G. Balman, Prentice Hall
2. Antennas and Wave Propagation - J.D. Kraus, RJ. Marhefka and Ahmad S. Khan. TMH, New Delhi, 4th ed., (Special Indian Edition), 2010
3. Electromagnetic Waves: R.K. Shevgaonkar, Tata McGraw Hill India
4. Antenna Wave Propagation: K.D. Prasad

Reference Books:

1. Modern Antenna Design: Thomas Milligan, Wiley Interscience , IEEE Press
2. Engineering Electromagnetics: Narayana Rao, 3rd ed., Prentice Hall
3. Electromagnetics: David Cheng, Prentice Hall
4. Principles of Electromagnetics: Matthew N. O. Sadiku

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

Course Code: 26EE05PR0606 **Course: Project Phase – II**

L: 0 Hrs, T: 0 Hr, P: 6 Hrs. Per week **Total Credits: 03**

Course outcomes

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

1. Implement project modules and circuit blocks final version.
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. IndepthstudyofthetopicassignedinthelightoftheReportpreparedunder ProjectStage-I
2. ReviewandfinalizationoftheApproachtotheProblemrelatingtotheassignedtopic
3. PreparinganActionPlanforconductingtheinvestigation,includingteamwork
4. DetailedAnalysis//Simulation/Design/ProblemSolving/Experimentasneeded
5. Finaldevelopmentofproduct/process,testing,results,conclusionsandfuturedirections
6. PreparingapaperforConferencepresentation/PublicationinJournals,ifpossible
7. PreparingaDissertationinthestandardformatforbeingevaluatedbytheDepartment
8. FinalSeminarPresentationbeforeaDepartmentalCommittee

SEMESTER – VII

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

Course Code: 26EE05TH0701 **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. Analyze MTC and D2D communication techniques in 5G
4. Evaluate spectrum management and bandwidth optimization in 5G
5. Conceptualize future communication solutions beyond 5G

Unit I

Foundations of 5G Networks: Evolution from 1G to 5G and key technological milestones, Benefits and limitations of 5G compared to earlier generations, Global standards and organizations shaping 5G development, 5G Use cases

Unit II

5G Architecture: Basics about RAN architecture, 5G New Radio Access Technology; 5G NR Global view; NR- PhysicalLayer: Radio Protocol Architecture, Functional architecture, 5G flexibility, Physical architecture and 5G deployment

Unit III

Machine Type Communication and Device-to-Device Communication: Use cases and categorization of MTC, MTC requirements; Fundamental techniques for MTC: Data andcontrol for short packets, non-orthogonal access protocols; Massive MTC, D2D: from 4G to 5G,Radio resource management for mobile broadband D2D

Unit IV

Spectrum and Bandwidth Management: Spectrum challenges in 5G, Spectrum allocation strategies for 5G deployment, High, mid and low band frequencies and their use cases, Bandwidth optimization techniques for high-performance networks, Regulatory and policy frameworks for spectrum management

Unit V

Beyond 5G – Emerging Technologies: Early research and vision for 6G communication systems, Integration of Satellite and non-terrestrial networks, Potential of quantum communication in future networks, Trends shaping evolution of global communication.

TEXT BOOKS:

1. AfifOsseiran, Jose F Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016
2. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies", CRC Press, Taylor & Francis Group, First Edition, 2018
3. HarriHolma, Antti Toskala, Takehiro Nakamura, "5G Technology 3GPP NEW RADIO", John Wiley & Sons, First Edition,2020

REFERENCE BOOKS:

1. Ali Zaidi, Fredrik Athley, Jonas Medbo, Ulf Gustavsson, Giuseppe Durisi, Xiaoming Chen, "5G Physical Layer, Principles, Models and Technology, Components, Academic Press, 2018.
2. Saad Z. Asif, "5G Mobile Communications: Concepts and Technologies", CRC Press, 2019.

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

Course Code: 26EE05TP0702 **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,Regionaldescriptors,Edge linking and boundary detection,

Unit – V:

Image Compression: Image compression fundamentals –coding Redundancy, spatial and temporal redundancy. Compression models- Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards

Text Books:

1) Digital image processing: *Rafel C. Gonzalez and Richard E. Woods, Addition-wisely*
2) Fundamental of digital image processing: *Anil K. Jain, PHI*

Reference Books:

1) Image Processing, Analysis and Machine Vision: *Milan Sonka, Vaclav Hlavac and Roger Boyle.*
2) Digital picture processing: *Rosenfeld A.C. Kak, academic press inc 1976.*
3) Computer image processing and recognition: *Hall E.L., academic press inc 1979.*
4) Picture processing and digital filtering: *Huang T.S., Springer Verlag, Berlin Heidelberg.*

Digital Image Processing Lab

Sr. No.	Experiment Title	Course Outcome
1.	Write Matlab script forreading given colour image and inspect its attributes, show it in gray and binary, resize and crop form.	CO1
2.	Write Matlab script forperforming quantization on given high resolution colour image to reduce colour depth.	CO1
3.	Write Matlab script for transforming image in frequency domain using DFT.	CO1, 2
4.	Write Matlab script for image analysis using DCT and Wavelet	CO2
5.	Matlab script for visualizing histogram of given image and perform histogram equalization for improving visual appeal of image.	CO3
6.	Matlab script for applying filter on a noisy image.	CO3,4
7.	Apply filter in frequency domain on a noisy image.	CO3,4
8.	Detecting edges, lines in a given image.	CO3,5
9.	Applying Intensity slicing technique on an image.	CO3,5
10	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: 26EE05TH0703 – 1 **Course: System Verification (Program Elective – 3)**

L: 3 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 04**

Course Outcomes:

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

1. Describe the VLSI design flow and various VLSI design styles in detail
2. Use algorithmic graph theory and combinatorial optimization techniques, as per requirement, to correctly formulate and solve VLSI design problems
3. Explain the algorithms for partitioning, floor planning, placement and routing of VLSI circuits anduse them to solve simple VLSI design problems.
4. Describe the process of Static Timing Analysis of VLSI circuits.

Unit – I:

Introduction to VLSI CAD : VLSI design methodologies, use of VLSI CAD tools, Algorithmic GraphTheory and computational Complexity.

High-level Synthesis : Hardware Models for High-level Synthesis, Internal Representation of the InputAlgorithm, and Understanding RTL to Gate Level design mapping. Basic concept of Static TimingAnalysis (STA).

Unit – II:

Partitioning : Introduction, Types of Partitioning, Classification of partitioning Algorithm, KLalgorithm.

Floor-planning : Introduction, Sliced and non-sliced planning, Polish expression, Power planning, IOPlanning

Unit – III:

Placement : Introduction, classification of placement algorithms, partition based placement, timing /congestion aware Placement

Unit – IV:

Clock Tree Synthesis : Different topologies of Clock Tree Structure. Overview on Clock Meshimplementation for High Performance designs.Routing: Fundamental Concepts of Steiner trees, Twophases of Routing: Global routing & detailed routing, Routing Algorithms

Unit – V:

Low Power Physical Design : Understanding Various Power Optimization algorithms (dynamic andLeakage). Overview on implementation and complexities involved in low power PD.

SOC Physical Design: Re-convergent model of VLSI SOC Design, SOC Physical design, advancedphysical design of SOCs.

Text books

1. VLSI Physical Design Automation: Theory and Practice: Sadiq M. Sait, Habib Youssef, McGraw-Hill 2004.
2. VLSI Physical Design: From Graph Partitioning to Timing Closure: Jin Hu, Jens Lienig, Igor L. Markov, Andrew B. Kahng, Springer, Dordrecht 2011.
3. Handbook of Algorithms for Physical Design Automation: Charles J Alpert, Dinesh P Mehta, Sachin S Sapatnekar, CRC Press, 2008.
4. A Practical Approach to VLSI System on Chip (SoC) Design, Veena Chakravarthi, Springer International Publishing 2020

Reference books

1. Physical Design Essentials: An ASIC Design Implementation Perspective: Khosrow Golshan, Springer, (2007)
2. Static Timing Analysis for Nanometer Designs: A Practical Approach: J. Bhasker and Rakesh Chadha, Springer, (2009).
3. Practical Problems in VLSI Physical Design Automation, Sung Kyu Lim, Springer, (2008), ISBN 978-1402066269
4. Algorithms for VLSI Design Automation: Sabih H. Gerez and John Wiley,(1998).
5. An Introduction to VLSI Physical Design: Majid Sarrafzadeh and C. K. Wong, McGraw Hill, (1996).
6. Algorithms for VLSI Physical Design Automation: Naveed Sherwani, Kluwer Academic Pub., (1999).

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

Course Code:26EE05TH0703 – 2 **Course: Computer Vision (Program Elective – 3)**

L: 3 Hrs, T: 0 Hr, P: 2Hrs. Per week **Total Credits: 04**

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: 26EE05TH0703 – 3 **Course: Cryptography and Network Security (Program Elective – 3)**

L: 3 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 04**

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. Execute 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 VII, B. Tech. (Electronics and Communication Engineering)

Course Code:26EE05TH0704 – 1	**Course: SOC Design (Program Elective – 4)**
L: 3 Hrs, T: 0 Hr, P: 2Hrs. Per week	**Total Credits: 04**

Syllabus for Semester VII,

B. Tech. (Electronics and Communication Engineering)

Course Code: 26EE05TH0704 – 2 **Course: Generative AI (Program Elective – 4)**

L: 3 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 04**

Course Outcomes: At the end of the course, a student will be able to:

1. Utilize Generative AI fundamentals to apply autoencoders and GANs for image synthesis.
2. Analyze transformer-based architectures and large language models for diverse applications.
3. Use Prompt Engineering techniques to design and optimize effective prompts.
4. Apply Explainable AI techniques to interpret GenAI models and ensure responsible usage

Unit-1 Fundamentals of Generative AI Generative AI, Overview, history, applications, Generative vs. Discriminative models, Latent variables and representation learning, Types of generative models, challenges in Generative AI, Generative Model Lifecycle, Evaluation metrics: FID, IS, BLEU, Perplexity

Unit-2 Autoencoders and GANs. Autoencoders (AE): basic, denoising, and variational (VAE), Latent space interpretation and reconstruction loss, GANs: Generator-Discriminator framework, adversarial training, Variants: DCGAN, WGAN, Conditional GAN, CycleGAN, StyleGAN, Training challenges and stabilization techniques.

Unit-3 Large Language Models and Transformer Architectures

Introduction to LLMs, Evolution, Transformer architecture: self-attention, encoder-decoder structure, GPT, BERT, T5, LLaMA, DALL·E, fine-tuning paradigms, Applications: summarization, translation, code generation, chatbots, challenges and limitations.

Unit 4: Introduction to Prompt Engineering

Prompt Engineering basics, Prompting strategies: zero-shot, few-shot, chain-of-thought Self-consistency Meta-prompting, Key Elements of Effective Prompts, Prompting in multimodal models: CLIP, DALL·E, Stable Diffusion, Evaluation of prompts and prompt optimization

Unit 5: Explainable and Responsible Generative AI

Explainable AI basics, XAI techniques: SHAP, LIME, Integrated Gradients, attention visualization, Explainability in LLMs and GANs. Responsible AI: principles, bias and

fairness in generative models, Regulatory frameworks and ethical guidelines (EU AI Act, OECD AI Principles, NIST AI Risk Framework)

TEXT BOOKS:

1. Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, David Foster, O'Reilly Media, 2nd Edition,2022.

2. The Art of Prompt Engineering with ChatGPT: A Hands-On Guide - Learn AI Tools the Fun Way, Shroff/Hunter; First Edition,2023.

3. Interpretable Machine Learning,: A Guide for Making Black Box Models Explainable, Christoph Molnar ,Shroff/Molnar, Second Edition,2020.

4. Responsible AI: Best Practices for Creating Trustworthy AI Systems, Qinghua Lu, Liming Zhu, et al, Pearson publisher, Ist Edition, 2024.

REFERENCE BOOKS:

1 Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville MIT Press, 2016.

2 Transformers for Natural Language Processing, Denis Rothman Packt Publishing, 2nd Edition, 2022.

3 Prompt Engineering for Generative AI, James Phoenix, Mike Taylor, O'Reilly, 2024.

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

Course Code:26EE05TH0704 – 3 **Course: Wireless Sensor Networks (Program Elective – 4)**

L: 3 Hrs, T: 0 Hr, P: 2Hrs. Per week **Total Credits: 04**

Course outcomes

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

1. Understand sensor networks and types of Wireless Sensor Networks (WSN)
2. Comprehend Routing and MAC protocols for different communication standards used in WSN
3. Explore new protocols for WSN.
4. Analyze the performance of Mobile Ad-hoc Networks (MANETs) and WSN.
5. Conduct case study of wireless sensor networks for a given application.

Unit –I:

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks.

Unit – II:

Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks, Issues and challenges in wireless sensor networks.

Unit –III:

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee,

Unit – IV:

Dissemination protocol for large sensor network, Data dissemination, data gathering and data fusion, Quality of a sensor network, Real-time traffic support and security protocols.

Unit –V:

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication, Single-node architecture, Hardware

components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Text Books:

1. WaltenegusDargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks Theory and Practice”, By John Wiley & Sons Publications ,2011
2. SabrieSoloman, “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:26EE05PR0706 **Course: Capstone Project Phase – I**

L: 0 Hrs, T: 0 Hr, P: 6Hrs. Per week **Total Credits: 03**

Course outcomes

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

1. Identify the problem statement through a literature survey for multidisciplinary 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 version.
5. Test and validate individual project modules.

The students will carry out following tasks for Capstone 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 – VIII

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

Course Code:26EE05TH0801 – 1	**Course: Design for Testability (Program Elective – 5)**
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: 26EE05TH0801 – 2 **Course: RTOS and kernels (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. 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.

Unit –I: RTOS Overview:

Computer System Structure, Operating system basic, 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 VIII, B. Tech. (Electronics and Communication Engineering)

Course Code: 26EE05TH0801 – 3	**Course: Cognitive Radio (Program Elective – 5)**
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: 26EE05TH0802 – 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 Pres

Reference Books:

1) RF Microelectronics: Behzad Razavi-McGraw Hill.
2) Design of Analog CMOS integrated circuits: Behzad Razavi- McGraw Hill.

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

Course Code: 26EE05TH0802 – 2 **Course: Speech and Audio Processing (Program Elective – 6)**

L: 3 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 04**

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

Course Code: 26EE05TH0802 – 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,NetworkAnalyzer, Spectrum Analyzer and measurement of spectrum of a microwave signal. Measurement of Microwave antenna parameters.

Unit – V:

Applications of Microwave Engineering – Radar block diagram, Radar range equation, CW & FM Modulated radar, MTI & Pulse Doppler Radar, Tracking Radar, Radar Receivers, Radar antenna.

Text Books:

1. MicrowaveCircuits, R. E. Collins, McGraw Hill.
2. MicrowaveCircuits, K. C. Gupta and I. J. Bahl, Artech house.

Reference Books:

1. Microwave device and circuits: Samuel Y. Lio, 3 Edition, PHI.
2. Introduction of radar systems: Skolilik, McGraw hill.
3. Microwave theory and measurement: G. Lance.

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

Course Code:26EE05PR0803 **Course: Capstone Project Phase – II**

L: 0 Hrs, T: 0 Hr, P: 12 Hrs. Per week **Total Credits: 06**

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

1. Implement project modules and circuit blocks final version.
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

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The students will carry out following tasks for Capstone Project Phase – II

1. IndepthstudyofthetopicassignedinthelightoftheReportpreparedunder Capstone Project Stage-I
2. ReviewandfinalizationoftheApproachtotheProblemrelatingtotheassignedtopic
3. PreparinganActionPlanforconductingtheinvestigation,includingteamwork
4. DetailedAnalysis//Simulation/Design/ProblemSolving/Experimentasneeded
5. Finaldevelopmentofproduct/process,testing,results,conclusionsandfuturedirections
6. PreparingapaperforConferencepresentation/PublicationinJournals,ifpossible
7. PreparingaDissertationinthestandardformatforbeingevaluatedbytheDepartment
8. FinalSeminarPresentationbeforeaDepartmentalCommittee

Syllabus for Semester VIII,

B. Tech. (Electronics and Communication Engineering)

Course Code:26EE05PR0804 **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:26EE05TH0305 – 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.

Module I: Introduction to Sensors and Transducers

Definitions of Sensors, Transducers, and Actuators. Classification of Sensors and Actuators based on Signal Type (Analog and Digital) and Energy Domain (Active, Passive, Mechanical, Electrical, and Thermal). Measurement System and Block Diagram; Static and Dynamic Characteristics of Sensors including Accuracy, Resolution, Drift, Linearity, and Hysteresis; Error Sources, Standards, and Calibration Procedures.

Module II: Physical Sensing Mechanisms and Sensors

Mechanical and Displacement Sensors: Potentiometers, LVDT, and Capacitive Sensors. Thermal Sensors: Thermistors, RTDs, and Thermocouples with Characteristics and Comparison. Pressure and Force Sensors: Strain Gauge and Piezoelectric Sensors. Motion and Acceleration Sensors: MEMS Accelerometers and Gyroscopes. Light and Radiation Sensors: LDR, Photodiode, Phototransistor, Photoconductive and Photovoltaic Sensors. Chemical and Bio-Sensors: Gas Sensors (MQ Series), pH Sensors, Glucose Sensors, ECG, and SpO2 Sensors.

Module III: Actuators and Their Operating Principles

Classification of Actuators: Mechanical, Electrical, and Fluidic Actuators. Electromagnetic Actuators: DC Motors, Stepper Motors, and Servo Motors with Working and Control Principles. Thermal Actuators: Shape Memory Alloys (SMA) and Thermopiles. Piezoelectric Actuators: Operating Principle and Applications; Hydraulic and Pneumatic Actuators: Force Generation and Control Applications; Signal Conditioning and Driver Circuits (Qualitative Overview).

Module IV: Smart Sensors

Smart Sensors: Architecture, On-Chip Signal Processing, and Self-Calibration. Comparison between Conventional and Smart Sensors. Digital Communication Protocols: UART, I2C, and SPI (Basics). Microelectromechanical Systems (MEMS): Basics and Applications in Sensing and Actuation; Miniaturization and Integration Trends in Sensor-Actuator Systems.

Module V: Sensor and Actuator Selection and Applications

Selection Criteria for Sensors and Actuators: Range, Sensitivity, Resolution, Linearity, and Power Requirements; Case Studies in Industrial Automation: Position Sensing and Pressure Control; Health Care Systems: Wearable Sensors and Haptic Feedback; Automotive Applications: Proximity Sensors and Throttle/Steering Actuators; Consumer Electronics: Touch Sensors and Vibration Motors; Reliability, Environmental Considerations, Lifecycle, and 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:26EE05TH0407 – 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: Analyse and optimize IoT solutions for power, connectivity, and scalability.

Module I: Introduction to IoT and ESP32 Fundamentals

Introduction to Internet of Things (IoT), IoT Architecture, Applications, and Ecosystem covering Smart Homes, Industrial Automation, Healthcare, Agriculture, and Smart Cities. Role of Microcontrollers in IoT Systems for Sensing, Processing, Communication, and Control Applications. Comparative Study of Arduino, ESP8266, ESP32, and Raspberry Pi Pico based on Architecture, Connectivity, Processing Capability, GPIO, Memory, and Power Consumption. Introduction to ESP32 including Features, Dual-Core Architecture, GPIO Interfacing, Memory Organization, Wi-Fi and Bluetooth Connectivity, ADC, DAC, PWM, Timers, UART, SPI, and I2C Peripherals.

Laboratory Practice on Installation and Configuration of Arduino IDE, ESP32 Board Setup, Driver Installation, Basic Programming, Compilation, Uploading, and Serial Monitor Testing.

Module II: ESP32 Programming and Interfacing

Introduction to ESP32 Programming Environment and GPIO Configuration. Digital Input and Output Programming using LEDs, Push Buttons, and Switches. Analog Input and Output Interfacing using ADC and DAC Features of ESP32. Pulse Width Modulation (PWM) for Brightness and Speed Control Applications. Interrupt Handling Techniques and Event-Driven Programming using External Interrupts. Interfacing of Analog Sensors such as Temperature and Light Sensors using ADC of ESP32. Interfacing of Digital Sensors including DHT11 Temperature and Humidity Sensor and Ultrasonic Distance Sensor. Actuator Interfacing using Relays, DC Motors, and Basic Motor Driver Circuits.
Laboratory Practice including LED Blinking, Push Button Interfacing, PWM-Based LED Dimming and Buzzer Control, Interrupt-Based Applications, Sensor Data Acquisition, Real-Time Monitoring, and Data Display on Serial Monitor and OLED Display using ESP32.

Module III: Communication Interfaces and Peripheral Integration

Serial Communication Protocols including I2C, SPI, and UART using ESP32. Interfacing of External Modules such as RFID Readers, OLED Displays, GPS Modules, and Sensor Interfaces. Data Transmission and Peripheral Communication Techniques for Embedded and IoT Applications. ESP32 Wi-Fi Configuration, Network Connectivity, and Internet-Based Communication. Web Server Creation using HTML and CSS for Remote Monitoring and Control Applications.

Laboratory Practice on I2C OLED Display Interfacing, SPI-Based Sensor Module Integration, UART Communication, Wi-Fi Connectivity, Web Server Development, and Real-Time Data Exchange using ESP32.

Module IV: Wireless Communication and Cloud Integration

Bluetooth Classic and Bluetooth Low Energy (BLE) Communication Techniques using ESP32. MQTT Protocol, Cloud Connectivity, and IoT Platform Integration using ThingSpeak, Blynk, Firebase, or MIT App Inventor. Wireless Sensor Data Monitoring and Remote Control Applications for IoT Systems. Design and Development of Cloud-Connected Embedded Systems for Smart Monitoring Applications.

Laboratory Practice on Development of IoT-Based Weather Station for Sensor Data Acquisition, Wi-Fi Communication, Mobile Application Integration, and Cloud Dashboard Monitoring using ESP32.

Module V: Power Management and IoT Deployment

Power Management Techniques in ESP32 including Deep Sleep Modes and Power Optimization Methods. Battery-Powered and Solar-Powered IoT System Design Considerations. Flashing Procedures, Firmware Management, and Over-the-Air (OTA) Updates. Reliability, Maintenance, and Deployment Considerations in IoT Systems. Case Studies on Real-World IoT Deployments using ESP32 in Smart Home, Industrial, Healthcare, and Environmental Monitoring Applications.

Laboratory Practice on ESP32 Deep Sleep Configuration, Wake-Up Mechanisms using Timer and Sensor-Based Interrupts, and Low-Power IoT System Development using ESP32.

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/MIT App Inventor, MQTT Broker
Languages: C/C++

Text Books

1. Raj Kamal, Internet of Things: Architecture and Design Principles, McGraw Hill Education.
2. ArshdeepBahga and Vijay Madisetti, Internet of Things – A Hands-On Approach, Universities Press.
3. Agus Kurniawan, ESP32 for Arduino IDE Programmers, PE Press.

Syllabus for Semester V

(MDM – 3 [Embedded Systems and IoT Track])

Course Code:26EE05TH0506-1 **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, 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, NFCLoRa, NB-IoT, Sigfox, 5GApplication 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:26EE05TH0607 – 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

(Mobile Communication Track)

Syllabus for Semester III,

(MDM – 1 [Mobile Communication Track])

Course Code:26EE05TH0305 – 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 DivisionMultiple Access (TDMA), Frequency Division MultipleAccess (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 [Mobile CommunicationTrack])

Course Code:26EE05TH0407 – 2 **Course: Cellular 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 Cellular 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

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. ItiSahaMisra, "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 [Mobile CommunicationTrack])

Course Code:26EE05TH0506 – 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 [Mobile CommunicationTrack])

Course Code:26EE05TH0607 – 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, 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. AfifOsseiran, 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. HarriHolma, Antti Toskala, Takehiro Nakamura, "5G Technology 3GPP NEW RADIO", John Wiley & Sons, First Edition,2020

MDM COURSES

(Microelectronics Track)

Course Code	26EE05TH0305-3				
Category	MDM				
Course Title	Microelectronics Foundation				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	III

Course Outcomes

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

CO1: Comprehend the semiconductor wafer fabrication process and analyze the fundamental device physics, I-V characteristics, and scaling limitations of MOS transistors.

CO2: Evaluate the static and dynamic electrical characteristics, noise margins, and structural trade-offs of various CMOS logic families.

CO3: Apply analytical mathematical models (such as RC delay, Elmore delay, and Logical Effort) to estimate gate-level performance and quantify sources of power dissipation.

CO4: Interpret physical layout methodologies (stick diagrams, lambda design rules) and explain standard cell characterization parameters (PVT corners, .lib formats) from a theoretical perspective.

Syllabus

Module 1: Semiconductor Physics and Microelectronics Foundation [6 Hrs]

Crystal growth, photolithography, ion implantation, etching, and metallization. Introduction to modern foundry cleanroom standards and Process Design Kits (PDKs).

Module 2: MOS Device Physics, Scaling, and Advanced Nodes [7 Hrs]

MOSFET operations, I-V characteristics, and parasitic capacitances. Technology Scaling principles (Moore's Law, Dennard Scaling, Constant-Field vs. Constant-Voltage scaling). The breakdown of scaling: advanced short-channel effects, velocity saturation, and sub-threshold leakage. The structural evolution from planar MOSFETs to FinFETs and Gate-All-Around (GAA) architectures to combat scaling limits.

Module 3: CMOS Logic and Inverter Characteristics [7 Hrs]

Voltage transfer characteristics (VTC). Static CMOS logic, ratioed logic, dynamic CMOS (Domino, np-CMOS), and pass-transistor logic. Noise margins and logic evaluation metrics.

Module 4: Delay, Power, and Local Interconnects [8 Hrs]

RC delay modeling, Elmore delay, and the Method of Logical Effort for sizing gate chains. Sources of power dissipation (dynamic, static, short-circuit). Modeling local wire capacitance and resistance.

Module 5: Layout Methodologies and Cell Characterization [7 Hrs]

Stick diagrams and standard cell layout techniques. Lambda-based vs. absolute design rules. Antenna rules and latch-up prevention. Cell characterization (Liberty .lib), PVT corners, and timing/power lookup tables.

Text Book:

1. CMOS VLSI Design: A Circuits and Systems Perspective (4th Edition) by Neil H. E. Weste & David Harris, Pearson, 2014

2. Digital Integrated Circuits: A Design Perspective (2nd Edition) by Jan M. Rabaey, Anantha Chandrakasan, & Borivoje Nikolic, Pearson, 2003.

3. Semiconductor Devices: Physics and Technology (3rd Edition) by Simon M. Sze & Ming-Kwei Lee, Wiley, 2012.

Course Code	26EE05TH0407-3				
Category	MDM				
Course Title	Digital Subsystem Design				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	IV

Course Outcomes

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

CO1: Design transistor-level architectures for high-speed datapath elements, such as adders and multipliers.

CO2: Analyze the circuit-level structure, stability, and performance of dense memory arrays (SRAM and DRAM).

CO3: Analyze the impact of global interconnect scaling, cross-talk, and transmission line effects on overall chip performance.

CO4: Formulate solutions for chip-level integration challenges, including clock distribution networks and power grid stability.

Syllabus

- **Module 1: Datapath Subsystem Architectures [8 Hrs]**

  Transistor-level architecture of massive computational blocks: High-speed adders (Carry-bypass, Carry-select, Tree/Prefix adders), multipliers (Array, Wallace Tree, Booth encoding), and ALUs. Optimizing datapaths for critical path delay vs. area.

- **Module 2: Memory Array Subsystems [8 Hrs]**

  Architecture of dense memory cores. Transistor-level design of SRAM (6T cell stability/sizing) and DRAM arrays. Non-volatile memories (Flash, ROM). Design of critical peripheral circuitry: sense amplifiers, address decoders, and wordline drivers.

- **Module 3: Global Interconnects and Communication [6 Hrs]**

  Moving beyond local wires: addressing global RC scaling and inductive effects. Transmission line behavior, cross-talk, and capacitive coupling on deep sub-micron wires. Circuit techniques for driving massive capacitances: optimal repeater insertion, cascaded buffer sizing, and differential signaling for robust, high-speed on-chip data buses.

- **Module 4: Timing and Clock Distribution Networks [7 Hrs]**

Subsystem-level timing issues: combating clock skew and jitter. Designing global clock distribution networks (H-trees, clock grids). Synchronous vs. asynchronous design philosophies, self-timed pipelines, and local vs. global timing metrics.

- **Module 5: Power Distribution and Packaging Integrity [6 Hrs]**

  Designing block-level power delivery networks (PDN). Mitigating dynamic power integrity issues: di/dt noise (ground bounce) and IR drop. Sizing and placement of on-chip decoupling capacitors. Design of subsystem physical interfaces: I/O pad circuitry, electrostatic discharge (ESD) protection basics, and voltage level-shifters for multi-VDD macro blocks.

Text Book:

1. CMOS VLSI Design: A Circuits and Systems Perspective (4th Edition) by Neil H. E. Weste & David Harris, Pearson, 2014

2. Digital Integrated Circuits: A Design Perspective (2nd Edition) by Jan M. Rabaey, Anantha Chandrakasan, & Borivoje Nikolic, Pearson, 2003.

3. CMOS Digital Integrated Circuits Analysis & Design (4th Edition) by Sung-Mo Kang, Yusuf Leblebici, & Chulwoo Kim, McGraw-Hill Education, 2014.

Course Code	26EE05TH0506-3				
Category	MDM				
Course Title	ASIC Design				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	V

Course Outcomes (COs):

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

CO1: Analyze the logic synthesis process, Clock Domain Crossing (CDC) methodologies, and the role of timing constraints (SDC) in generating an optimized netlist.

CO2: Evaluate macro floorplanning strategies, power grid distribution planning, and standard cell placement algorithms for congestion and area optimization.

CO3: Examine the algorithms behind Clock Tree Synthesis (CTS) and global/detailed routing, and analyze their impact on Signal Integrity (SI) and electromigration.

CO4: Apply Static Timing Analysis (STA) principles to identify setup and hold violations, and comprehend the physical sign-off checks (DRC, LVS) required for final GDSII generation.

Modules:

Module 1: Synthesis, CDC, and Constraints [9 Hrs]

Translating logic to gate-level netlists. Clock Domain Crossing (CDC) analysis, multi-flop synchronizers, and asynchronous FIFOs. Writing Synopsys Design Constraints (SDC) for clocks, false paths, and I/O delays.

Module 2: Floorplanning and Power Planning [8 Hrs]

Core area estimation, macro placement heuristics, and routing blockages. Designing the Power Grid/Rings. Multi-VDD domains, power-gating, and interpreting Unified Power Format (UPF).

Module 3: Placement and Clock Tree Synthesis (CTS) [10 Hrs]

Placement algorithms (simulated annealing, min-cut). Congestion-driven placement and tie-cell insertion. Goals of CTS: minimizing skew and latency. Buffer insertion, delay balancing, and post-CTS hold-time fixing.

Module 4: Signal Routing and Signal Integrity (SI) [9 Hrs]

Global vs. detailed routing algorithms (Maze routing). Handling Design Rule Constraints (spacing, via rules). Mitigating SI issues in layout: crosstalk delay, crosstalk noise (glitch), and Electromigration (EM) fixing.

Module 5: Static Timing Analysis (STA) and Sign-Off [9 Hrs]

Exhaustive setup and hold timing closure using STA engines across On-Chip Variation (OCV) and PVT corners. Parasitic extraction (SPEF). Physical verification for tape-out: Design Rule Checking (DRC) and Layout Versus Schematic (LVS), concluding with final GDSII / OASIS database generation for foundry manufacturing.

Reference Books:

1 VLSI Physical Design: From Graph Partitioning to Timing Closure (2nd Edition) by Andrew B. Kahng, Jens Lienig, Igor L. Markov, & Jin Hu, Springer, 2022.

2 Advanced ASIC Chip Synthesis: Using Synopsys Design Compiler, Physical Compiler, and PrimeTime (2nd Edition) by Himanshu Bhatnagar, Springer, 2002.

3 Static Timing Analysis for Nanometer Designs: A Practical Approach by J. Bhasker & Rakesh Chadha, Springer, 2009.

4 Physical Design Essentials: An ASIC Design Implementation Perspective by Khosrow Golshan, Springer, 2007.

5 Constraining Designs for Synthesis and Timing Analysis: A Practical Guide to Synopsys Design Constraints (SDC) by Sridhar Gangadharan & Kattamuri Ekanath Seth, Springer, 2013

Course Code	26EE05PR0607-3				
Category	MDM				
Course Title	Project				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	6	3	VI

HONORS COURSES

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

Course Code:26EE05HT0301 **Course: Communication System Analysis (HONORS Course)**

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

Course Outcomes:

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

1. Describe the basic building blocks of communication systems.
2. Explain the concepts of advanced communication systems.
3. Apply convolution techniques in the context of communication signals
4. Demonstrate the application of software-defined radio (SDR) and cognitive radio in modern communication systems
5. Analyze the performance benefits of using spread spectrum techniques in communication systems

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Unit 1:

Introduction to Communication Systems

Basic building blocks of communication systems, overview of Analog and Digital communication systems, channel types, channel capacity, modeling, noise, performance indices.

Unit 2:

Signal Analysis

Applications of Fourier Transform, Properties, Autocorrelation, Energy Spectral Density, Convolution, Random Variables, Probability Density Functions in communication systems.

Unit 3:

Introduction to Wireless Communication

Basics of Cellular Systems, Wireless Channel Models, Large Scale Fading, Small Scale fading, Error Performance in AWGN and Fading channel, Multiple Access techniques.

Unit 4:

Spread Spectrum Communication Systems

Spreading sequences, Properties of Spreading Sequences, Pseudo- noise sequence, Orthogonal Sequences, Types of spread spectrum systems, probability of error.

Unit 5:

Modern Communication Systems

Introduction to 5G and Beyond, MIMO Systems and Spatial Diversity, Software-Defined Radio (SDR), Cognitive Radio, Communication System Security and Privacy

Textbooks

1. "Communication Systems" by Simon Haykin, 4th Edition, Wiley Publications
2. "Digital Communication" by John G. Proakis, McGraw Hill Publications
3. "Modern Wireless Communication" by K. Sam Shanmugan

Reference books:

1. Ke-Lin Du & M N S Swamy, "Wireless Communication System", Cambridge University Press, 2010
2. Behrouz A Forouzan, "Data Communications and Networking", 4th Edition, McGraw Hill.
3. William H. Tranter, K. Sam Shanmugan, T. S Rappaport, Kurt L. Kosbar, Principles of Communication System Simulation with Wireless Applications, 2011, 1st Edition, Prentice Hall Press, USA

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

Course Code:26EE05HT0401 **Course: Multimedia Networks (HONORS Course)**

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

Course outcomes

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

1. Functioning of circuit switched and packet switched networks
2. Reasons for emergence of converged communication networks
3. Various media coding algorithms and their applications
4. Emerging trends in multimedia networks.

Unit I
Review of circuit switched digital telephony, signaling and transmission, ISDN, SS7. Evolution of packet switched networks, Internet and LANs. The TCP/IP protocol stack.

Unit II
Introduction to XoIP, network convergence, Needs of individual users, enterprises and network operators. How XoIP is expected to meet all these concerns.

Unit III
Source coding (speech, audio and video coding) PCM, ADPCM, LP coding, CELP, RPE-LTP, adaptive sub-band coding, MPEG standards for audio and video coding.

Unit IV
Signaling protocols: Review of H.323, MEGACO protocols, Session Initiation Protocol (SIP), detailed study of SIP, implementation of SIP through Java.
Media Transport: Need of special media transport protocols, RTP, RTCP, RTSP, QoS issues, routing, security etc.

Unit V
Modern network technologies: Mobile communication 3G, 4G, IMS, wireless LANs, wired networks. New services like IP-TV, multimedia conference calls, presence management, device and access independent services. VXML based applications

Text Books:

1) O. Hersent, D. Gurle and JP Petit- "IP Telephony", Pearson Education Asia.
2) J. D. Gibson (Editor) "Multimedia Communications" – Harcourt India.

Reference Books:

1) Bill Douskalis "IP Telephony", Prentice Hall.
2) R. Wittman, M.Zitterbart-Morgan Kaufman, "Multicast Communication".

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

Course Code:26EE05HT0501 **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 it's equalization techniques
3. Examine/ experiment various Error control coding techniques and its erformcance
4. Appraise Wireless communication systems

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. UpamanyuMadhow, 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 MIM"; 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:26EE05HT0601 **Course: MillimeterWave 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:26EE05MT0301 **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:26EE05MT0401 **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:26EE05MT0501 **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.

Unit I

Introduction to Internet of Things: Concept and its need, architecture, scope and applications, Overview of Networking and protocols applicable to IoT.

Unit II

Exploring the platforms/ hardware for IoT: Getting Started with Raspberry Pi, Basic and functionality of the Raspberry Pi board and its Processor, setting and configuring the board, differentiating Raspberry Pi from other platform like Arduino, Over-clocking, Component overview.

Unit III

Introduction to Linux: Implications of an operating system on the behaviour of the Raspberry Pi, Overview of Linux and its terminal command, apt-get-update, apt-get-upgrade, navigating the file system and managing processes, text-based user interface through the shell, overview of graphic user interface.

Unit IV

Programming the Raspberry Pi: Python: Introduction to Python programming language : Python Programming Environment, Python Expressions, Strings, Functions, Function Arguments, Lists, List Methods, Control Flow, Numpy, PIP (Python Installation Package) and customized libraries.

Unit V

Sensors and Actuators (Light Sensors, Ultrasonic, Temperature and humidity,etc) for IoT, Wired and Wireless communication, Communication facilities on raspberry Pi (I2C, SPI, UART), working with RPi. GPIO library, Communication Using Raspberry Pi for IoT applications.

Unit VI

Applications of IoT: case studies based on Commercial products, Applications / Product Development of IoT based application

Text Books:

1) Designing the Internet of Things, Adrian McEween and Hakim Cassimally, 1st Edition John Wiley and Sons, Ltd.

Reference Books:

1. Learning of Internet of Things, Peter Waher, 1st Edition Packet Publishing.
2. Raspberry Pi 3 : An Introduction to Using with PythonScratch, Javascript and more, Gary Mitnick, CreateSpace Independent Publishing Platform, 2017.
3. Raspberry Pi for Python Programmers Cookbook, Tim Cox, Packt Publishing Limited; 2nd Revised edition, 2016.
4. Raspberry Pi User Guide, Eben Upton and Gareth Halfacreee, John Wiley & Sons, 2016

Syllabus for Semester VI,

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

Course Code:26EE05MT0601 **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. ItiSahaMisra, "Wireless Communication and Networks – 3G and Beyond", Mc Graw Hill Education, Second Edition, 2013.
2. Jochen Schiller, "Mobile Communications", Pearson Education, Second Edition, 2012.