JSS MAHAVIDYAPEETHA

JSS SCIENCE & TECHNOLOGY UNIVERSITY, MYSURU

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF I TO VIII SEMESTER: 2020-2021

Scheme of Teaching and Examination for B.E (E&CE)

Vision

- **Advancing JSS S&T University as a leader in education, research and technology on the international arena.**
- **To provide the students a universal platform to launch their careers, vesting the industry and research community with skilled and professional workforce.**
- **Accomplishing JSS S&T University as an epicentre for innovation, centre of excellence for research with state of the art lab facilities.**
- **Fostering an erudite, professional forum for researchers and industrialist to coexist and to work cohesively for the growth and development of science and technology for betterment of society.**

Mission

1. **Education, research and social outreach are the core doctrines of JSS S&T University that are responsible for accomplishment of in-depth knowledge base, professional skill and innovative technologies required to improve the socio economic conditions of the country.**
2. **Our mission is to develop JSS S&T University as a global destination for cohesive learning of engineering, science and management which are strongly supported with interdisciplinary research and academia.**
3. **JSS S&T University is committed to provide world class amenities, infrastructural and technical support to the students, staff, researchers and industrial partners to promote and protect innovations and technologies through patents and to enrich entrepreneurial endeavors.**
4. **JSS S&T University core mission is to create knowledge led economy through appropriate technologies, and to resolve societal problems by educational empowerment and ethics for better living.**

Vision statement of the department of E&CE

Be a leader in providing globally acceptable education in electronics and communication engineering with emphasis on fundamentals-to-applications, creative-thinking, research and career-building.

Mission statement of the department of E&CE

1. **To provide best infrastructure and up-to-date curriculum with a conducive learning environment.**
2. **To enable students to keep pace with emerging trends in Electronics and Communication Engineering.**
3. **To establish strong industry participation and encourage student entrepreneurship.**
4. **To promote socially relevant eco-friendly technologies and inculcate inclusive innovation activities.**

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Semester Wise Credits

Semester	Credits	Total Marks
I	20	800
II	20	750
III	25	850
IV	25	850
V	25	850
VI	25	900
VII	19	600
VIII	16	300
Total	**175**	

Grading System

Marks	Grade
90 – 100	**S**
75 – 89	**A**
66 – 74	**B**
56 – 65	**C**
50 – 55	**D**
45 – 49	**E**
< 45	**F**

Notation in the Scheme

CIE	**Continuous Internal Evaluation**
SEE	**Semester End Examination**
L	**Lecture**
T	**Tutorial**
P	**Practical**

2 a. PROGRAM OUTCOMES (POs)

1. **Engineering Knowledge**: Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

2. **Problem Analysis**: Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences

3. **Design/ Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.

4. **Conduct investigations of complex problems**: Using research based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.

5. **Modern Tool Usage**: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

6. **The Engineer and Society**: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

7. **Environment and Sustainability**: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.

11. **Lifelong Learning**: Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

12. **Project Management and Finance**: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

2b. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. To enable the graduates to have strong Engineering fundamentals in Electronics & Communication, with adequate orientation to mathematics and basic sciences.

2. To empower graduates to formulate, analyze, design and provide innovative solutions in Electronics & Communication, for real life problems.

3. To ensure that graduates have adequate exposure to research and emerging technologies through industry interaction and to inculcate professional and ethical values.

4. To nurture required skill sets to enable graduates to pursue successful professional career in industry, higher education, competitive exams and entrepreneurship.

2c. PROGRAM SPECIFIC OUTCOMES (PSO'S)

1. Analyze, design and provide engineering solutions in the areas of electronic circuits and systems.

2. Demonstrate the mathematical modeling techniques, nurture analytical and computational skills to provide engineering solutions in the areas of electronics and communication.

3. Ability to address multidisciplinary research challenges and nurture entrepreneurship.

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Scheme of Teaching and Examination 2020-21

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2020-21)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF TEACHING AND EXAMINATION FOR B.E. IN (I - Year)

Scheme of Teaching and Examination for I semester (Chemistry Cycle) B.E.

SEMESTER: I

Sl. No.	Subject / Course Code	Subject / Course Title	Teaching Department	Contact Hours				CREDITS	Marks			Exam Duration
				L	T	P	TOTAL		CIE	SEE	TOTAL	
1	20MA110	Engineering Mathematics - I	Mathematics	3	2	0	5	4	50	50	100	3 Hours
2	20CH110	Engineering Chemistry	Chemistry	3	2	0	5	4	50	50	100	3 Hours
3	20CV110	Engineering Mechanics	Civil	3	0	0	3	3	50	50	100	3 Hours
4	20EC110	Elements of Electronics Engineering	E&C	3	0	0	3	3	50	50	100	3 Hours
5	20ME120	Engineering Graphics and Design	Mechanical	0	2	3	5	2.5	50	50	100	3 Hours
6	20CH12L	Engineering Chemistry Laboratory	Chemistry	0	0	3	3	1.5	50	50	100	3 Hours
7	20HU120	Innovation studies	Eng. Depts.	0	2	0	2	1	50	50	100	1Hrs 30 Min.
8	20HU130	Functional English	Humanities	0	2	0	2	1	50	50	100	1Hrs 30 Min.
							28	**20**	**Total Marks**		**800**	

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF TEACHING AND EXAMINATION FOR B.E. IN (I - Year)

Scheme of Teaching and Examination for II semester (Physics Cycle) B.E.

SEMESTER: II

Sl. No.	Subject / Course Code	Subject / Course Title	Teaching Department	Contact Hours				CREDITS	Marks			Exam Duration
				L	T	P	TOTAL		CIE	SEE	TOTAL	
1	20MA220	Engineering Mathematics - 2	Mathematics	3	2	0	5	4	50	50	100	3 Hours
2	20PH210	Engineering Physics	Physics	3	2	0	5	4	50	50	100	3 Hours
3	20ME210	Elements of Mechanical Engineering	Mech	3	0	0	3	3	50	50	100	3 Hours
4	20EC210	Elements of Electronics Engineering	E&C	3	0	0	3	3	50	50	100	3 Hours
5	20CS220	Introduction to Programming	CSE / ISE	3	0	0	3	3	50	50	100	3 Hours
6	20PH22L	Engineering Physics Laboratory	Physics	0	0	3	3	1.5	50	50	100	3 Hours
7	20CS22L	Computational Programming Laboratory	CSE / ISE	0	0	3	3	1.5	50	50	100	1Hrs 30 Min.
8	20HU210	Kannada	Humanities	0	0	0	2	0	50	-	50	-
							28	**20**	**Total Marks**		**750**	

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF TEACHING AND EXAMINATION FOR B.E. IN - II - Year

SEMESTER: III

Sl. No	Subject code	Course title	Category Code	Teaching Department	QP Setting Dept.	Contact Hours				Credits	Marks			Exam duration in hrs.
						L	T	P	TOTAL		CIE	SEE	Total	
1	20MA310	Mathematics III	BSC	Mathematics		3	0	0	3	3	50	50	100	03
2	20EC310	Circuit Theory and Analysis	PCC	ECE	ECE	3	2	0	5	4	50	50	100	03
3	20EC320	Sensors and Actuators	PCC	ECE	ECE	3	0	0	3	3	50	50	100	03
4	20EC330	Analog Electronic Circuits	PCC	ECE	ECE	3	0	2	5	4	50	50	100	03
5	20EC340	Digital System Design	PCC	ECE	ECE	3	0	0	3	3	50	50	100	03
6	20EC350	Communication Systems -I	PCC	ECE	ECE	3	0	0	3	3	50	50	100	03
7	20HU311	Universal Human Values (UHV)	HSMC	ECE	ECE	2	0	0	2	2	25	25	50	1.5
8	20EC37L	Digital System Design Lab	PCC	ECE	ECE	0	0	3	3	1.5	50	50	100	03
9	20EC38L	Hardware System Integration and Simulation Lab	PCC	ECE	ECE	0	0	3	3	1.5	50	50	100	03
		Total							30	25	Total marks		850*	

Note:

- **Environmental Studies course will be offered for the Programs with Physics Cycle of I Semester in 3rd Semester and in 4th semester in programs with Chemistry Cycle of I Semester.**
- **Universal Human Values course will be offered for the Programs with Chemistry Cycle of I Semester in third Semester and in 4th Semester of programs with Physics Cycle in I Semester.**
- **Credit calculation without UHV course: 4 credits x 4 subjects + 3 credits x 2 subjects+ 1.5 credits x 2 labs = 25.**
- **Credit calculation with UHV Course: 4 credits x 2 subjects + 3 credits x 4 subjects+ 2 Credits (HUV) +1.5 credits x 2 labs = 25.**
- **20MA311 will be offered for circuit programs and 20MA312 will be offered to non-circuit programs**
- *** Either 20HU311 or 20HU312 will be offered in 3rd Semester and hence the total marks are 850**

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF TEACHING AND EXAMINATION FOR B.E. IN - II - Year

SEMESTER: IV

Sl. No	Subject code	Course title	Category Code	Teaching Department	QP Setting Dept.	Contact Hours				Credits	Marks			Exam duration in hrs.
						L	T	P	TOTAL		CIE	SEE	Total	
1	20MA410	Mathematics IV	BSC	Mathematics		3	0	0	3	3	50	50	100	03
2	20EC410	Linear Integrated Circuits	PCC	ECE	ECE	3	0	2	5	4	50	50	100	03
3	20EC420	Microcontrollers and Embedded System	PCC	ECE	ECE	4	0	0	4	4	50	50	100	03
4	20EC430	Signals and Systems	PCC	ECE	ECE	3	2	0	5	4	50	50	100	03
5	20EC440	Communication Systems II	PCC	ECE	ECE	3	0	0	3	3	50	50	100	03
6	20EC450	Engineering Electromagnetics	PCC	ECE	ECE	4	0	0	4	4	50	50	100	03
7	20EC47L	Communication Lab I	PCC	ECE	ECE	0	0	3	3	1.5	50	50	100	03
8	20EC48L	Microcontrollers and Embedded System Lab	PCC	ECE	ECE	0	0	3	3	1.5	50	50	100	03
9	20HU412	Environmental studies*	HSMC	ECE	ECE	2	0	0	2	0	50	--	50	--
		Total							32	25	Total marks		850*	

Note:

- **Environmental Studies course will be offered for the Programs with Physics Cycle (I Semester) in 3rd Semester and offered in programs with Chemistry Cycle (I Semester) in 4th Semester.**
- **Universal Human Values course will be offered for the Programs with Chemistry Cycle (I Semester) in third Semester and offered in programs with Physics Cycle (I Semester) in 4th Semester.**
- **Credit calculation without UHV course: 4 credits x 4 subjects + 3 credits x 2 subjects+ 1.5 credits x 2 labs = 25.**
- **Credit calculation with UHV Course: 4 credits x 2 subjects + 3 credits x 4 subjects+ 2 Credits (HUV) +1.5 credits x 2 labs = 25.**
- **20MA411 will be offered for circuit programs and 20MA412 will be offered to non-circuit programs.**
- *** Either 20HU411 or 20HU412 will be offered in 3rd Semester and hence the total marks are 850**

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF TEACHING AND EXAMINATION FOR B.E. IN - III - Year

SEMESTER: V

Sl. No	Subject code	Course title	Category Code	Teaching department	QP Setting Dept.	Contact Hours				Credits	Marks			SEE Duration in hrs.
						L	T	P	TOTAL		CIE	SEE	Total	
1	20EC510	Linear Algebra and Applications	PCC	ECE	ECE	3	1	0	5	4	50	50	100	03
2	20EC520	Microwave and Antennas	PCC	ECE	ECE	4	0	0	4	4	50	50	100	03
3	20EC530	Control Systems	PCC	ECE	ECE	3	1	0	5	4	50	50	100	03
4	20EC540	Digital Signal Processing	PCC	ECE	ECE	4	0	0	4	4	50	50	100	03
5	20EC55x	Professional Elective-I	PEC	ECE	ECE	3	0	0	3	3	50	50	100	03
6	20XX56x	Open Elective-I	OEC	ECE	ECE	3	0	0	3	3	50	50	100	03
7	20EC57L	Digital Signal Processing Lab	PCC	ECE	ECE	0	0	3	3	1.5	50	50	100	03
8	20EC58L	Communication Lab II	PCC	ECE	ECE	0	0	3	3	1.5	50	50	100	03
9	20HU511/ 20HU512	Essence of Indian Traditional Knowledge	HSMC	Humanities		2	0	0	2	0	50	-	50	-
		Total							32	25	Total marks		850	

Note:

- **Open elective is open to all the students excluding the students of parent program.**
- **Indian traditional knowledge course will be offered for the Programs with Chemistry Cycle (I Semester) in 5th Semester and offered in programs with Physics Cycle (I Semester) in 6th Semester.**
- **Credit calculation: 4 credits x 4 subjects + 3 credits x 2 subjects + 1.5 credits x 2 labs = 25**

Professional Elective-I			
20EC551	Solid State Electronics	**20EC554**	Smart Electronics materials
20EC552	Neural Networks and Machine Learning	**20EC555**	Data structures and Algorithm
20EC553	Principles of wireless communication systems		

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Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF TEACHING AND EXAMINATION FOR B.E. IN - III - Year

SEMESTER: VI

Sl. No	Subject code	Course title	Category Code	Teaching department	QP Setting Dept.	Contact Hours				Credits	Marks			SEE Duration in hrs.
						L	T	P	TOTAL		CIE	SEE	Total	
1	20EC610	Information Theory and Coding	PCC	ECE	ECE	4	0	0	4	4	50	50	100	03
2	20EC620	Computer Networks	PCC	ECE	ECE	4	0	0	4	4	50	50	100	03
3	20EC630	CMOS VLSI Circuits	PCC	ECE	ECE	3	0	0	3	3	50	50	100	03
4	20EC64x	Professional Elective-II	PEC	ECE	ECE	3	0	0	3	3	50	50	100	03
5	20XX65x	Open Elective-II	OEC		ECE	3	0	0	3	3	50	50	100	03
6	20XX66x	Open Elective-III	OEC		ECE	3	0	0	3	3	50	50	100	03
7	20EC67L	CMOS VLSI Lab	PCC	ECE	ECE	0	0	3	3	1.5	50	50	100	03
8	20EC68L	Networking Lab	PCC	ECE	ECE	0	0	3	3	1.5	50	50	100	03
9	20EC69P	Design and Implementation Lab (Mini Project)	PWC	ECE	ECE	0	0	4	4	2	50	--	50	--
10	20HU611/ 20HU612	Essence of Constitution of India and Professional Ethics	HSMC	Humanities		2	0	0	2	--	50	--	50	--
		Total							32	25	Total marks		900	

Note:

- **Open elective is open to all the students excluding the students of parent program.**
- **Constitution of India course will be offered for the Programs with Physics Cycle (I Semester) in 5th Semester and offered in programs with Chemistry Cycle (I Semester) in 6th Semester.**
- **Team Size for Mini project can be between 1-4.**

Professional Elective-II			
20EC641	Robotics and Computer Vision	**20EC644**	Digital Image Processing
20EC642	Nanodielectrics: Challenges and Opportunities	**20EC645**	Mechatronics
20EC643	Modern Wireless Communication systems	**20EC646**	Operating Systems

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Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF TEACHING AND EXAMINATION FOR B.E. IN - IV - Year

SEMESTER: VII

Sl. No	Subject code	Course title	Category Code	Teaching department	QP Setting Dept.	Contact Hours				Credits	Marks			SEE Duration in hrs.
						L	T	P	TOTAL		CIE	SEE	Total	
1	20EC710	Innovation, Entrepreneurship and Management	HSMC	ECE	ECE	4	0	0	4	4	50	50	100	03
2	20EC72x	Professional Elective-III	PEC	ECE	ECE	3	0	0	3	3	50	50	100	03
3	20EC73x	Professional Elective-IV	PEC	ECE	ECE	3	0	0	3	3	50	50	100	03
4	20XX74x	Open Elective-IV	OEC		ECE	3	0	0	3	3	50	50	100	03
5	20XX75x	Open Elective-V	OEC		ECE	3	0	0	3	3	50	50	100	03
6	20EC76P	Project Work Phase - 1	PWC			--	--	4	4	2	50	--	50	--
7	20EC77P	Industrial training /Internship	PWC			0	0	2	2	1	50	--	50	--
									22	19	Total marks		600	

Note:

- **Students can take SWAYAM courses from 3rd semester to 6th semester and qualification certificate is to be submitted to the department before the commencement of 7th semester for considering in Professional elective IV* offered in 7th Semester.**
- **HOD's shall be preparing list of subjects offered under SWAYAM and it should be minimum of 12 weeks (12weeks or 8+4 or 4+4+4 or any other combination).**
- **Students who could not qualify/ complete the SWAYAM course from 3rd to 6th semesters should register for professional elective-IV in 7th semester.**
- **Open elective is open to all the students excluding the students of parent program.**
- **Classes for 7th Semester preferred to be conducted only on Thursday to Saturday to encourage students to undergo internship in the Industry from Monday to Wednesday (Internship/Industrial Training).**
- **Students can take mini project or industrial training or internship (any one). A guide should be allotted to each student/ group at the department level to monitor the progress.**

Professional Elective-III		Professional elective-IV*	
20EC721	Speech Processing using Deep Learning	**20EC731**	Nanoscience and Technology
20EC722	Embedded Systems	**20EC732**	Statistical Signal Detection and Processing
20EC723	Internet of Things (IoT)	**20EC733**	Cryptography and Network Security
20EC724	Quantum Computing and Communication	**20EC734**	Wavelet and compression techniques
20EC725	Bio Medical Signal Processing	**20EC735**	Advanced Computer Networks
20EC726	Protocol Engineering and Technology	**20EC736**	Deep Learning for Computer Vision

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF TEACHING AND EXAMINATION FOR B.E. IN - IV - Year

SEMESTER: VIII

Sl. No	Subject code	Course title	Category Code	Teaching department	QP Setting Dept.	Contact Hours				Credits	Marks			SEE Duration in hrs.
						L	T	P	TOTAL		CIE	SEE	Total	
1	20EC81x	Professional Elective-V	PEC	ECE	ECE	3	0	0	3	3	50	50	100	03
2	20EC82x	Professional Elective-VI	PEC	ECE	ECE	3	0	0	3	3	50	50	100	03
3	20EC83P	Project work Phase - 2	PWC			--	--	20	20	10	70	30	100	03
		Total							26	16	Total marks		300	

Note:

1. **The evaluation of the project work shall be done in four phases. 70 % weightage shall be given for the performance of the student in 1st (20 Marks), 2nd (20 Marks) and 3rd phases (30 Marks) evaluation (CIE) and 30 Marks for 4th phase evaluation (SEE).**
2. **Project Evaluation (Phase 1,2&3) should be done at the department Level Immediately after the 1st, 2nd and 3rd Theory test respectively.**
3. **Three-member committee will be formed (including the guide) at the department level to evaluate the project progress in phase 1, 2 & 3. This same committee will evaluate and finalize the CIE in all the phases. (Committee should remain same except for special cases).**
4. **Project team size can be 1-4.**
5. **Classes for 8th Semester preferred to be conducted only on Saturdays from 7.30AM to 1.30PM. Students should be allowed to work in the Industry from Monday to Friday (Internship), which may or may not be linked to the Project Work.**

	Professional Elective-V		Professional Elective-VI
20EC811	Automotive Electronics	**20EC821**	Low power VLSI
20EC812	Cloud Computing	**20EC822**	Mobile Computing
20EC813	Digital Compression Techniques	**20EC823**	Assistive Technology
20EC814	Advanced Embedded system	**20EC824**	Advanced Vehicular Network
20EC815	Operations Research	**20EC825**	Optical Networks and Sensors

Category Code:

BSC – Basic Science Course
ESC – Engineering Science Course
PCC – Professional Core Course (Including Laboratory subjects)
PEC- Professional Elective Course
OEC- Open Elective Course
HSMC – Humanities Social Science and Management Course
PWC – Project Work Course

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List of SWAYAM Courses identified by the department (for Professional Elective – IV): (Students can complete 12 Weeks of SWAYAM course/s between 3-6th Semester to claim exemption for Elective - IV)

(Note: Student can take any of SWAYAM course in the following list or any other SWAYAM course after taking approval from HOD)

Sl. No.	SWAYAM Course Title	No of Weeks
1	Optical Communications	12 Weeks
2	Research Methodology and Statistical Analysis	
3	Sustainability Science	
4	Advanced Engineering Mathematics	
5	Electric Vehicles and Renewable Energy	
6	Integrated Photonics Devices and Circuits	
7	Linux Bash	
8	Linux Operating System	
9	SCILAB	
10	Introduction to Photonics	
11	Integrated Photonics Devices and Circuits	
12	Introduction to Medical Imaging Systems	
13	Integrated Circuits, MOSFETS, Op-amps and their Applications	
14	Applied Electromagnetics for Engineers	
15	Fabrication Techniques for MEMS based Sensors	
16	Linear Systems	
17	Mathematical Aspects of Biomedical Electronics	
18	Academic Research & Report Writing	8 Weeks
19	Power Quality Improvement Technique	
20	Robotics and Control : Theory and Practice	
21	A brief course on Superconductivity	4 Weeks
22	A brief introduction of Micro - Sensors	
23	C Programming and Assembly Language	
24	Introduction to probability and Statistics	
25	Patent Drafting for Beginners	

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Scheme of Teaching and Examination 2020-21

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2020-21)

List of open electives offered by the department of Electronics and Communication Engineering

Sl.No.	Semester :elective	Course Code	Course Title
1	5: Open Elective – 1	20EC561OE	CMOS VLSI Circuits
2		20EC562OE	Sensors and Actuators
3		20EC563OE	Wireless Communication
4		20EC564OE	Control System
5		20EC565OE	Smart Materials
6	6: Open Elective – 2	20EC651OE	Nanoscience and Technology
7		20EC652OE	Automotive Electronics
8		20EC653OE	Smart Agricultural Technology
9		20EC654OE	Low power VLSI
10		20EC655OE	Artificial Intelligence and Deep Learning
11	6: Open Elective – 3	20EC661OE	Bioelectronics and Biosensors
12		20EC662OE	Optimization Techniques for Engineers
13		20EC663OE	Professional Communication and technical Report Writing.
14		20EC664OE	Verilog HDL
15		20EC665OE	Nanoscience and Technology
16	7: Open Elective – 4	20EC741OE	Product Design and development
17		20EC742OE	Hybrid Vehicles
18		20EC743OE	Deep learning for NLP
19		20EC744OE	ASIC
20		20EC745OE	Embedded systems
21	7: Open Elective - 5	20EC751OE	Analog and Mixed Mode VLSI
22		20EC752OE	Wireless Sensor Networks
23		20EC753OE	Mobile Computing
24		20EC754OE	Robotics and Computer Vision
25		20EC755OE	Industrial Automation
26		20EC756OE	Telecommunication System Modelling and simulation

JSS MAHAVIDYAPEETHA

JSS SCIENCE AND TECHNOLOGY UNIVERSITY

SRI JAYACHAMARAJENDRA COLLEGE OF ENGINEERING, MYSURU

Scheme of Teaching and Examination 2020-21

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2020-21)

Subject Break up of credits AICTE / Adapted

Sl. No.	Category	Suggested break up of credits	
		AICTE	Adapted scheme
1.	Humanities & Social Sciences including Management courses	12	08
2.	Basic Science courses	25	25
3.	Engineering Science courses	24	23
4.	Professional core courses	48	70
5.	Professional elective courses	18	18
6.	Open electives	18	15
7.	Project work/internship/seminar	15	15
8.	Mandatory courses (noncredit)	3 non-credit courses	Same courses are offered
Total		160	175

Distribution of Credits among various Curricular Components

Curricular Components / Semester	I	II	III	IV	V	VI	VII	VIII	Course Total	Percentage
Humanities and Social Sciences, Management (HS)	1	1	2				4		8	4.57 %
Basic Science (BS)	9.5	9.5	3	3					25	14.28%
Engineering Science (ES)	9.5	9.5							19	10.85%
Professional Core (PC)			20	22	19	14			75	42.85 %
Professional Elective (PE)					3	3	6	6	18	10.28%
Open Elective (OE)					3	6	6		15	8.57%
Project / Mini Project (P)						2	2	10	14	8.00 %
Seminar – Internship (S)							1		1	0.57 %
Non Credit Mandatory (NC)				1	1	1				0
Total Credits	20	20	25.0	25.0	25.0	25.0	19.0	16.0	175	99.97%*

Department: Electronics and Communication Engineering	
Course Title: Elements of Electronics Engineering	***Course Code: 20EC110 / 20EC210***
Credits (L:T:P): 3:0:0	***Total Contact Hours: 40:0:0***
Type of Course: Lecture	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 100***

Course Outcomes: After completing this course, students should be able to:

CO1:	List the characteristics of electronic devices.
CO2:	Describe the working of devices, circuits and equipment's.
CO3:	Apply the concepts to realize analog and digital circuits.
CO4:	Analyze the need of devices and equipment's for particular application.

Unit No.	Course Content	No. of Hours
1	**Analog Electronics:** Diode characteristics with load line and its application- rectifiers, Clipper and clamper, working principles of Zener and photo diodes, BJT characteristics with load line and applications - switch and amplifier, JFET and MOSFET Characteristics and its applications.	08
2	**Digital Electronics:** Binary arithmetic's operation, Basic and universal Logic Gates, simplification and realization of Boolean expression (SOP, POS), combinational and sequential logic.	08
3	**Integrated Circuits:** Differential amplifiers, Op-amps and its application, IC regulators, Digital IC, Timers Circuits.	08
4	**Communication Basics:** Introduction, EM spectrum and Applications, Modulation & its types, Principles of wireless communication, Computer communication, MODEM.	08
5	**Devices and Equipment's:** Signal generator, CRO, SMPS, Multimeter, OLED, LCD and IOT based devices, Microwave Oven, Processor and Microcontroller, Different types of sensors and Actuators.	08

Text Book:

1. **Robert Boyelstad**: "Electronic Devices and circuit theory", 11thEdition, Pearson, 2015.
2. **Ramakant A. Gayakwad**, "Op-Amps and Linear Integrated Circuits", 4th Edition, Pearson, 2015

Reference Books:

1. **Floyd and Jain,** "Digital Fundamentals", 11th Edition, Pearson, 2017.
2. **B.P. Lathi and Zhi Ding** , "Modern Digital And Analog Communication Systems 4th Edition (Paperback) South Asia edition, Oxford 2017..

E-Resource:

1 http://www.freebookcentre.net/Electronics/Communication-Books.html
2 http://www.freebookcentre.net/Electronics/Devicesandequipments-Books.html
3 http://nptel.ac.in/courses/108102095/

CO-PO Mapping (Course Articulation Matrix):

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012
CO1	3											
CO2		3										
CO3			3									
CO4			2		2				2	2		2

1---Low association, 2--- Moderate association, 3---High association

Department: Electronics and Communication Engineering	
Course Title: Engineering Mathematics-III	***Course Code: 20MA310***
Credits (L:T:P): 3:0:0	***Total Contact Hours: 39:0:0***
Type of Course: Lecture	***Category: Basic Science***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Engineering Mathematics-I and II.

Course Outcomes: After completing this course, students should be able to:

CO1:	Apply least square method to fit a curve for the given data and evaluate the correlation coefficient and regression lines for the data.
CO2:	Determine the nature of the events and hence calculate the appropriate probabilities of the events.
CO3:	Formulate and solve partial differential equations. Use of separation of variable method to solve wave, heat and Laplace equations.
CO4:	Apply numerical techniques to solve Engineering problems and fit a least squares curve to the given data.
CO5:	Construct the Fourier series expansion of a function/tabulated data.

Unit No.	Course Content	No. of Hours
1	**Statistics:** Introduction, Definitions, Curve Fitting, equation of Straight line, parabola and exponential, correlation and regression, formula for correlation coefficient, regression lines and angle between the regression lines.	08
2	**Random Variable:** Discrete Probability distribution, Continuous Probability distribution, expectation, Variance, Moments, Moment generating function, Probability generating function, Binomial distribution, Poisson distribution, Normal distribution and Exponential distributions.	08
3	**Partial differential equations (P.D.E.):** Formation of Partial Differential Equation, Solution of Lagrange's Linear P.D.E. of the type Pp+Qq=R. Method of Separation of Variables. **Applications of P.D.E.:** Classification of PDE, solution of one dimensional heat and wave, two dimensional Laplace's equation by the method of separation of variables.	08
4	**Numerical solution of Ordinary differential equations:** Taylor's series method, Euler's and modified Euler's method, fourth order Runge-Kutta method**.**	07
5	**Fourier Series:** Periodic functions, Fourier Expansions, Half Range Expansions, Complex form of Fourier series, Practical Harmonic Analysis	08

Text Book:

1. **B.S.Grewal,** "Higher Engineering Mathematics", 43rd edition, Khanna Publications, 2015.
2. **Ramana .B.V**, **"**Higher Engineering Mathematics"**,** latest edition, Tata-McGraw Hill, 2016

Reference Books:

3. **C. Ray Wylie and Louis C. Barrett,** "Advanced Engineering Mathematics", 6th edition, Tata-McGraw Hill 2005.
4. **Louis A. Pipes and Lawrence R. Harvill,** "Applied Mathematics for Engineers and Physicists", 3rd edition, McGraw Hill 2014.

5. **Erwin Kreyszig,** "Advanced Engineering Mathematics" , 10th edition, Wiley Publications, 2015

Mapping - Course Outcomes with Program outcomes & Program Specific outcomes:

Course Outcomes	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	2	2											2		
CO2	2	2											2		
CO3	2	2											2		
CO4	2	2											2		
CO5	2	2											2		

1---Low association, 2--- Moderate association, 3---High association

Department: Electronics and Communication Engineering	
Course Title: Circuit Theory and Analysis	***Course Code: 20EC310***
Credits (L:T:P): 3:1:0	***Total Contact Hours: 52:0:0***
Type of Course: Lecture	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Ohm's law, Kirchoff's voltage and current law, equivalent resistance in parallel and series combination of resistors, mathematical operations of complex numbers, active and passive components.

Course Outcomes: After completing this course, students should be able to:

CO1:	Explain the fundamentals of network terminologies and concepts essential for problem solving.
CO2:	Analyze the network theorems to solve for the given AC/DC circuits.
CO3:	Solve the given network/circuit problems using circuit analysis techniques.
CO4:	Demonstrate the skill sets using software tools for simulation of circuit problems.

Unit No.	Course Content	No. of Hours
1	**Basic concepts:** Introduction, Network terminologies, Energy sources – ideal and practical, Mesh Analysis of DC and AC circuits, Circuits with independent voltage sources only Mesh analysis – circuits containing independent current sources and dependent sources, Concept of super mesh, Nodal analysis - Circuits containing independent current sources, Nodal analysis – circuits containing dependent sources, Concept of super node, Star – Delta transformations and network reduction using them, Source transformations and related problems.	11
2	**Network Theorems:** Superposition theorem, problems. Thevenin's theorem as applied to AC and DC circuits, Norton's theorem as applied to DC and AC circuits, Maximum power transfer theorem as applied to DC and AC circuits, Mill man's theorem, applications and problems.	11
3	**Resonance and Initial Conditions:** Series resonance, resonant frequency, reactance curves, voltage and current variable with frequency, Selectivity and bandwidth, Q – factor, circuit magnification factor Selectivity with variable C and variable L Parallel resonance, resonant frequency, impedance, selectivity, bandwidth Maximum impedance conditions with C, L, and f variable, current and Q – factor. Need for Initial conditions in R, L, and C elements. Final conditions and Geometrical interpretation of derivatives, Procedure to evaluate initial conditions. Initial state of a network.	10
4	**Circuit Analysis using Laplace Transforms and Fourier series:** Review of Laplace transforms, Natural and Forced responses, Advantages of LT techniques, Modeling R, L, and C in s – domain, DC transients, Step response of RC, RL and RLC circuits, Impulse and Pulse response of RC and RL circuits and AC transients, Circuit analysis with LT using partial fraction expansion and convolution integral. Applications of Fourier techniques to circuit analysis, Waveform symmetry, Line spectrum, Waveform synthesis Effective value and power, problems, Application of FS in circuit Analysis.	10

5	**Network Functions and Two Port parameters:** Concept of complex frequency, Network functions for one and two – port networks. Poles and zeros of network functions, Restrictions on pole and zero locations for driving point functions and transfer functions, Time domain behavior from pole – zero plots. Short – Circuit admittance parameters, Open circuit impedance parameters, Transmission parameters, Hybrid parameters, problems, Relationships between parameters, problems.	10

Text Books:

1. **Charles K Alexander, Mathew N. O. Sadiku,** "Fundamentals of Electric Circuits" 5th Edition, McGraw Hill Education (India) Pvt Ltd New Delhi, Reprint 2016.
2. **J. David Irwin, Robert M Nelms,** "Engineering Circuit Analysis", 10 Edition, Wiley India Pvt Ltd, Reprint 2013.

Reference Books:

1. **M.E.VanValkenburg:** "Network Analysis", 3rd edition, Pearson/ PHI, Reprint 2006.
2. **D. Roy Choudhury:** "Networks and Systems", New Age International, Reprint 2005.

Web Resources:

1. https://nptel.ac.in/courses/108102042/3
2. https://nptel.ac.in/courses/117106108
3. https://play.google.com/store/apps/details?id=com.education.nptelee&hl=en

Mapping - Course Outcomes with Program outcomes & Program Specific outcomes

Course Outcomes	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	-	3	3	-	-	-	-	-	-	-	-	-	-	-	2
CO4	-	-	2	2	3	2	-	2	2	3	2	2	-	-	2

1---Low association, 2--- Moderate association, 3---High association

Department: Electronics and Communication	
Course Title: Sensors and Actuators	***Course Code: 20EC320***
Credits (L: T:P): 3:0:0	***Total Contact Hours: 39:0:0***
Type of Course: Lecture	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Student should be familiar with basic concepts of Electronics.

Course Outcomes: After completing this course, students should be able to:

CO1:	Explain the working principle of transducers, sensors and actuators.
CO2:	Apply the basic knowledge of sensors and actuators in solving and designing an instrumentation system.
CO3:	Analyze the applications of transducers, smart sensors and actuators.
CO4:	Demonstrate suitable sensors and transducers for real time applications.

Unit No.	Course Content	No. of Hours
1	**UNIT 1: Instrumentation system and Transducers:** Introduction, generalized functional block diagram, input output configuration, Advantages of Electronic measurement, Errors in measurement, Types of Errors, static characteristics, dynamic characteristics, calibration and standards, process of calibration. Transducers, Selecting a transducer, Electrical transducers, Resistive transducer, Resistive position transducer, Strain gauges.	8
2	**UNIT 2: Analog Sensors and Transducers:** Introduction, principles, classification, characterization, Shaft Encoders, Incremental Optical Encoder, Variable-Inductance Transducers, Variable-Capacitance Transducers, Piezoelectric Sensors, Sensors for Electromechanical Applications, Photo emissive cells, Photoconductive cells – Measurement of physical quantities. Microsensors. Acoustic sensors, Ultrasonic based sensors.	8
3	**UNIT 3: Actuators:** Introduction, Functional components of an actuator, Actuator as a system component, Intelligent & Self sensing actuators, microactuation, MEMS with microactuators, piezoelectric actuators, Application examples (Automatic anti-lock braking systems).	8
4	**UNIT 4: Smart Sensors:** Smart sensors: Introduction Primary Sensors, Information coding / processing, Data communication, automation. Concept and architecture of intelligent sensors, onboard automobile sensors, home appliance sensors, biomedical application, Introduction to MEMS and Microsystems, Microsystems and Microelectronics Multidisciplinary nature of microsystem design and manufacture, applications of microsystems, Nano sensors.	8
5	**UNIT 5: Interfacing Methods and Circuits:** Introduction, Amplifiers, Power Amplifiers, Digital Circuits, Bridge Circuits, Data Transmission, Noise and Interference.	7

SLE: Future Trends in Neurosensors, Biosensors, Nano-technology, Soft Computing techniques in instrumentation.

Text Books:

1. **Clarence W. de Silva,** "Sensors and Actuators Engineering System Instrumentation", CRC Press, 2nd Edition, 2016.
2. **D Patranabis,** "Sensors and Transducers" PHI Ltd, 2nd Ed, 2003.

3. **Tai-Ran Hsu**: "MEMS & Microsystems Design and Manufacture", Tata McGraw Hill, 2007.
4. **Nathan Ida:** "Sensors, Actuators, and their Interfaces", SciTech Publishing Inc, 2nd Edition, 2020.

Reference Books:

1. **H.S. Kalsi,** "Electronic Instrumentation", Tata McGraw-Hill, 3rd Ed, 2010.
2. **Stefan Johann Rupitsch**, "Piezoelectric Sensors and Actuators": Fundamentals and Applications, Springer-Verlag Berlin Heidelberg, 2019.
3. **Hartmut Janocha**, "Actuators Basics and Applications", Springer publication, 2013.
4. **D.V.S. Murthy**: "Transducers and Instrumentation", PHI Ltd, 2nd Ed, 2010.

Web Resources:

1. https://nptel.ac.in/courses/108/108/108108147/
2. https://www.coursera.org/lecture/interface-with-arduino/lecture-2-1-actuators-uNCa4

Mapping - Course Outcomes with Program outcomes & Program Specific outcomes

	Program outcomes												Program specific outcomes		
EC320	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														
CO2		3											2		
CO3		3	3											2	
CO4	2			3	3				3			2		2	2

1---Low association, 2--- Moderate association, 3---High association

Department: Electronics and Communication Engineering	
Course Title: Analog Electronic Circuits	***Course Code: 20EC330***
Credits (L:T:P): 3:0:1	***Total Contact Hours: 39:0:20***
Type of Course: Lecture	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Elements of Electronics Engineering

Course Outcomes: After completing this course, students should be able to:

CO1:	Explain the working principle of various analog electronic circuits and explore their applications.
CO2:	Analyze the important relations for analog electronic circuits and interpret the results.
CO3:	Design analog electronic circuit for the given specifications.
CO4:	Demonstrate an analog electronic circuit for the given specifications.

Unit No.	Course Content	No. of Hours
1	**BJT amplifier circuits:** Introduction, BJT circuits at DC, small-signal operation and models, single-stage BJT amplifier, CE, CB & CC amplifiers, SPICE BJT model and simulation.	08
2	**MOS amplifier circuits:** Introduction, MOSFET circuits at DC, small-signal operation and models, single-stage MOS amplifier, CS, CG & CD amplifiers, SPICE FET model and simulation.	08
3	**Frequency Response:** General consideration, Low frequency response of BJT and MOSFET amplifiers, Miller's theorem, High frequency response of BJT and MOSFET amplifiers, SPICE simulation.	07
4	**Feedback amplifiers and Oscillators:** General feedback structure, negative feedback, feedback topologies, feedback amplifiers, loop gain and stability, phase shift oscillator, LC and crystal oscillator (BJT and FET based), SPICE simulation.	08
5	**Output stages and Power amplifiers:** Introduction, classification, Class A, B, AB, C output stage, Switched Mode Power Amplifiers, IC power amplifiers, CMOS class AB output stage, SPICE simulation.	08

Text Books:

1. **Adel S. Sedra and K. C. Smith,** "Microelectronic Circuits," 7th/8th Ed. 2018 Oxford University Press India.

Reference Books:

1. **Robert Boyelstad**, "Electronic Devices and circuit theory", 11th Edition, Pearson, 2015.
2. **Millman & Halkias**, "Electronic Devices and Circuits" 4th Edition, McGraw-Hill Education, 2015.
3. **U B Mahadevaswamy,** "Analog Electronics Circuits", Sanguine Publications, Revised Edition 2010.

Web Resources:

1. E-Book: http://www.freebookcentre.net/Electronics/Analog-Circuits-Books.html
2. Video Lecture: http://nptel.ac.in/courses/108102095/

Mapping - Course Outcomes with Program outcomes & Program Specific outcomes

Course Outcomes	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3												2		
CO2		3											2	3	
CO3			3											3	2
CO4	3	3	3	3	3				3			3	3	3	2

1---Low association, 2--- Moderate association, 3---High association

Integrated Course Lab Experiments:

Part A

1. Clippers and Clampers Circuits.
2. Rectifiers.
3. BJT characteristics.
4. MOSFET characteristics.
5. Frequency response of single stage RC – Coupled Amplifier.

Part B

6. RC – Low pass and High Pass filters.
7. BJT Darlington Emitter follower circuit.
8. Voltage series feedback amplifier.
9. Negative Feedback amplifier.
10. Oscillators.

Course Title: Digital System Design	***Course Code: 20EC340***
Credits (L:T:P): 3:0:0	***Total Contact Hours: 39:0:0***
Type of Course: Integrated	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Elements of electronics engineering

Course Outcomes: After completing this course, students should be able to:

CO1	Explain the concept of combinational and sequential logic circuits.
CO2	Analyze the working of combinational and sequential logic circuits.
CO3	Design the combinational and sequential circuits for the given specifications.
CO4	Demonstrate the functionality of digital circuit/system using Verilog HDL

Unit No.	Course Content	No. of Hours
1	**Principles, Analysis and design of combinational logic:** Definition of combinational logic, canonical forms, Generation of Boolean expressions from truth tables, Karnaugh maps-3,4,5 variables. Decoders, Encoders, multiplexers, demultiplexers, Adders and subtractors, Look ahead carry, Binary comparators.	08
2	**Flip-Flops and its Applications:** Basic Bistable elements, Latches, master-slave flip-flops (pulse-triggered flip-flops): SR flip-flops, JK flip-flops, Characteristic equations, Registers, binary ripple counters, and synchronous **Sequential Circuit Design:** Design of a synchronous counter, synchronous mod-n counter using clocked JK and D, Design of a Sequence Detector **Sequential System:** Mealy and Moore models, State machine notation, Construction of state diagrams.	08
3	**Applications of Digital Circuits:** Guidelines for construction of state graphs, Design Example – Code Converter, Serial Adder with Accumulator, Design of Binary Multiplier, Design of Binary Divider. Design of Sequential Circuits using ROMs and PLAs, CPLDs and FPGAs..	08
4	**Verilog HDL Basic Concepts**: Lexical conventions, datatypes, system tasks, compiler directives. **Modules and Ports:** Module definition, port declaration, connecting ports, hierarchical name referencing. **Gate-Level Modeling:** Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays.	08
5	**Dataflow Modeling:** Continuous assignments, delay specification, expressions, operators, operands, operator types. **Behavioral Modeling:** Structured procedures, initial and always, blocking and non blocking statements, generate statement, conditional statements, loops, sequential and parallel blocks. **Tasks and Functions:** Differences between tasks and functions, declaration, invocation, automatic tasks and functions.	07

Text Books:

1. **John M Yarbrough, -**"Digital Logic Applications and Design", 1st Edition Thomson Learning, 2006.

2. **Donald D. Givone,** - "Digital Principles and Design", 1st Edition, McGraw Hill, 2003.
3. **Charles H Roth Jr., Larry L. Kinney** – "Fundamentals of Logic Design", Cengage Learning, 7th Edition. 2020.
4. **Samir Palnitkar,** "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, Second Edition.

Reference Books:

1. **R D Sudhaker Samuel, —**"An Illustrative Approach to Logic Design", 1st Edition Pearson, 2010.
2. **Morris Mano**, —"Digital Design", 6th Edition, Prentice Hall of India. 2018
3. **K. A. Navas**, —"Electronics Lab Manual", Volume I, 5th Edition, PHI, 2015.

Mapping - Course Outcomes with Program outcomes & Program Specific outcomes

Course Outcomes	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3												2		
CO2		3												2	
CO3			3												2
CO4	3	3	3	3	2	2			2			2			2

0 -- No association 1---Low association, 2--- Moderate association, 3---High association

Department: Electronics and Communication	
Course Title: Communication System-I	***Course Code: 20EC350***
Credits (L: T:P): 3:0:0	***Total Contact Hours: 39:0:0***
Type of Course: Lecture	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: NIL or list of few subjects studied in previous semesters which makes pre requisite for this course.

Course Outcomes: After completing this course, students should be able to:

CO1:	Explain the importance of electronic communication systems.
CO2:	Analyze and evaluate various analog modulation and demodulation techniques through analytical and simulation methods.
CO3:	Design and demonstrate the various frequency synthesis techniques.
CO4:	Demonstrate the working of analog communication system for the given application.

Unit No.	Course Content	No. of Hours
1	**Introduction**: Introduction to electronic communication systems, power measurement units, EM frequency spectrum, bandwidth and channel capacity and data rate, signal analysis and mixing, brief review of modern telecommunication system.	07
2	**AM Modulation and Demodulation:** analysis of signals, amplitude modulation and demodulation, generation of AM wave: square law modulator, switching modulator, detection of AM waves: square law detector, envelop detector. Double side band suppressed carrier modulation (DSBSC): Time - Domain description, Frequency - Domain representation. Generation of DSBSC waves: Balanced modulator, ring modulator. Coherent detection of DSBSC modulated waves. Costas loop.	08
3	**SSB generation and frequency synthesizers:** Quadrature carrier multiplexing, Hilbert transform, properties of Hilbert transform. SSB generation, frequency - domain description of SSB wave, mathematical analysis of suppressed carrier systems, SSB reception. SSB measurements and FDM. Generation of VSB modulated wave, frequency domain description of VSB wave. Comparison of amplitude modulation techniques, Phase lock loops. PLL capture and lock ranges, PLL loop gain, phase comparators and frequency synthesizers.	08
4	**FM modulation and Demodulation**: Basic definitions of FM, Deviation sensitivity, narrow band FM, wide band FM, transmission bandwidth of FM waves, generation of FM waves: Indirect FM and direct FM. Demodulation of FM waves: Balanced slope detector, Foster seeley discriminator.	08
5	**Noise Analysis** : Noise in communication system- noise analysis, equivalent noise temperature, and cascade connection of two port network, sampling and A/D conversion of signals, transmission band width and SNR, Multiplexing,	08

Text Books:

1. **Wayne Tomasi** – "Electronic Communication Systems" 5th edition, Pearson Education, 2007

2. **B. P. Lathi** "Modern digital and analog Communication systems", 4th edition, Oxford University Press, 2010,

Reference Books:

1. **Simon Haykins** "Communication Systems", 5th edition, John Wiley, 2009.
2. **Michael Fitz** "Fundamentals of Communication Systems", TMH, 2008 (for MATLAB exercises and mini projects)
3. **Sanjay Sharma** "Analog Communication Systems", 2nd edition, 2007

Web Resources:

1. https://nptel.ac.in/courses
2. https://nptel.ac.in/courses

Mapping - Course Outcomes with Program outcomes & Program Specific outcomes

Course Outcomes	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3														
CO2		3											2		
CO3			3											2	
CO4	2	2	2	2	2				2			2			2

1---Low association, 2--- Moderate association, 3---High association

Department: Electronics and Communication Engineering	
Course Title: Universal Human Values	***Course Code: 20HU311***
Credits (L:T:P): 2:0:0	***Total Contact Hours: 26:0:0***
Type of Course: Lecture	***Category: Humanities & Social Sciences including Management courses***
CIE Marks: 25	***SEE Marks: 25***

Pre-requisite: Students Induction Program (desirable).

Course Outcomes: After completing this course, students should be able to:

CO1:	Become more aware of themselves, and their surroundings (family, society, and nature); they would become more responsible in life, and in handling problems with sustainable solutions, keeping human relationships and human nature in mind.
CO2:	Have better critical ability and also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).

Unit No.	Course Content	No. of Hours
1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education:** Recapitulation from Universal Human Values-I, Self-Exploration; 'Natural Acceptance' and Experiential Validation. A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.	05
2	**Understanding Harmony in the Human Being - Harmony in Myself!** Understanding human being as a co-existence of the sentient 'I' and the material 'Body. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Health.	05
3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship:** Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family	05
4	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence:** Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature-	05

	recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all pervasive space. Holistic perception of harmony at all levels of existence.	
5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics:** Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics. Case studies of typical holistic technologies. Strategy for transition from the present state to Universal Human Order	06

Text Books:

1. **R R Gaur, R Sangal, G P Bagaria,** "Human Values and Professional Ethics"Excel Books, New Delhi, 2010

Reference Books:

1. **A Nagaraj**, "Jeevan Vidya: Ek Parichaya", Jeevan Vidya Prakashan, Amarkantak, 1999.
2. **A.N. Tripathi,** "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. **Mohandas Karamchand Gandhi** "The Story of My Experiments with Truth"
4. **J C Kumarappa** "Economy of Permanence"

Web Resources:

1. https://onlineethics.org/

CO-PO Mapping (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						1	2	2				
CO2						1	1	1				

1---Low association, 2--- Moderate association, 3---High association

Department: Electronics and Communication	
Course Title: Digital System Design Lab	***Course Code: 20EC37L***
Credits (L:T:P): 0:0:1.5	***Total Contact Hours: 0:0:30***
Type of Course: Lecture	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 50***

Pre-requisite: Elements of Electronics Engineering

Course Outcomes: After completing this course, students should be able to:

CO1:	Design the digital logic circuits as per the given specifications.
CO2:	Demonstrate the working of digital logic circuits using hardware components/Verilog HDL

EXP No.	**Course Content**	**No. of Hours**
1.	Design and implement of i) Adder/ subtractor using logic gates ii) 4-bit Parallel adder/Subtractor using IC 7483	3
2.	Design and implement of i) Code convertors., Design ii) one-bit comparator and Magnitude comparator using IC 7485.	3
3.	Design and implement of i. Mod-N synchronous/Asynchronous up and down counters using 7476 JK flip-flop IC. ii. Synchronous counter using IC 74192.	3
4.	Realize and implement the following shift registers using IC 7474/7495: SISO, SIPO, PISO, PIPO, Ring and Johnson counter.	3
5.	**SLE:** Design of Serial adder with accumulator and design of binary multiplier and division using software tool.	3
	Verilog HDL simulation lab experiments:	
6.	Design of 2-to-4 decoder, and 8-to-3 encoder (without and with parity)	3
7.	Design of 8-to-1 multiplexer and 1-to-8 de-multiplexer	3
8.	Design of 4 bit comparator and full adder using 3 modeling styles	3
9.	Design of flip flops: SR, D, JK, T	3
10.	Design of 4 bit binary, BCD counters (Synchronous/ asynchronous reset)	3

Course Outcomes	**Program Outcomes**												**PSO's**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3	3						2			2	2		
CO2	3	3	3	3	2				2	2		2		2	2

1---Low association, 2--- Moderate association, 3---High association

Department: Electronics and Communication	
Course Title: Hardware Systems Integration and Simulation Lab	***Course Code: 20EC38L***
Credits (L: T:P): 0:0:1.5	***Total Contact Hours: 0:0:39***
Type of Course: Practical	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 50***

Pre-requisite: Basic Electronics**.**

Course Outcomes: After completing this course, students should be able to:

CO1:	Analyze hardware and software sub-systems and configure them for running the simulation.
CO2:	Demonstrate basic skills required for Printed Circuit Board (PCB) design and developmer

EXP No.	**Course Content**	**No. of Hours**
	PART-A: (Emphasis to Linux systems)	
1.	Essentials of PC Hardware (Hardware subsystems and technology)	3
2.	External interfaces to PC (Wired and Wireless)	3
3.	Command usage practice (user/admin/network level commands)	3
4.	Programming practice under Unix/Linux environment	3
	PART-B:(Emphasis to use Octave/Python software tools)	
5.	Compute and verify various mathematical operations, Matrix operations	3
6.	Compute and verify string operations, number system conversion and graphical plot commands.	3
7.	Simulate and verify branch currents and voltages in DC circuits.	3
8.	Simulate and verify branch currents and voltages in AC circuits	3
9.	Simulate and verify branch currents and voltages in transistor circuits.	3
	PART-C: PCB Design Skills	
10.	i. Design using CAD Tools ii. Etching Process in the Lab iii. Soldering and Testing of final PCB	3

Text Books:

1. **Syed Mansoor Sarwar, Robert M Koretsky,** "Linux The Textbook" CRC Press Second Edition – 2018
2. **Richard Fox, "**Linux with Operating System Concepts" Taylor & Francis publisher 2014

Mapping Course Outcomes with Program outcomes & Program Specific outcomes

Course Outcomes	**Program Outcomes**												**PSO's**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3	3			3								3		
CO2	2	3	3	3	3				3			3		2	2

1---Low association, 2--- Moderate association, 3---High association

IV SEMESTER

Department: Electronics and Communication Engineering	
Course Title: Engineering Mathematics-IV	***Course Code: 20MA410***
Credits (L: T:P): 3:0:0	***Total Contact Hours: 39:0:0***
Type of Course: Lecture	***Category: Basic Science***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Engineering mathematics 1, 2 & 3.

Course Outcomes: After completing this course, students shall be able to:

CO1:	Apply numerical techniques to solve Engineering problems and fit a least squares curve to the given data
CO2:	Evaluate Fourier transforms and use Z-transform to solve difference equations.
CO3:	Examine and construct the analytic functions.
CO4:	Classify singularities of complex functions and evaluate complex integrals.
CO5:	Ability to solve system of linear equations, carryout matrix operations, determines the eigenvalues & eigenvectors.

Unit No.	Course Content	No. of Hours
1	**Numerical Differentiation and Numerical Integration**: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson's1/3rd rule and Simpson's 3/8th rule. Applications to Engineering problems**.**	07
2	**Fourier Transforms:** Finite and Infinite Fourier transform, basic properties, convolution theorem; inverse transforms; **Z-transforms:** z-transforms and inverse z-transforms; solution of difference equation	08
3	**Complex Variables-I:** Functions of complex variables, Analytic function, Cauchy-Riemann equations in Cartesian and polar coordinates, Consequences of Cauchy-Riemann equations, Construction of analytic functions.	08
4	**Complex Variables-II:** Complex integration, Cauchy theorem, Cauchy integral formula, Taylor and Laurent series (statements only), Singularities, Poles and residues, Cauchy residue theorem.	08
5	**Linear Algebra:** System of linear equations, Row operations, Echelon form Reduced Echelon form, Solution of Homogeneous and Non homogeneous equations, vector equations, Linear combinations, Linear independent/dependent vectors, Eigen values, Eigen vectors, Diagonalizations, Solving a system of differential equations using diagonalization.	08

Text Books:

1 **B.S.Grewal,** "Higher Engineering Mathematics", 43rd edition, Khanna Publications, 2015.
2 **Ramana .B.V,** "Higher Engineering Mathematics", latest edition, Tata-McGraw Hill, 2016
3 **Ralph P. Grimaldi,** "Discrete and Combinatorial Mathematics", 4th Edition, PHI/Pearson Education, 2005.

Reference Books:

1 **Erwin Kreyszig,** "Advanced Engineering Mathematics" , 10th edition, Wiley Publications, 2015.

2 **C. Ray Wylie and Louis C. Barrett**, "Advanced Engineering Mathematics", 6th edition, Tata-McGraw Hill 2005.

3 **Louis A. Pipes and Lawrence R. Harvill**, "Applied Mathematics for Engineers and Physicists", 3rd edition, McGraw Hill 2014.

4 **Ralph P. Grimaldi**, "Discrete and Combinatorial Mathematics", 4th Edition, PHI/Pearson Education, 2005

Mapping - Course Outcomes with Program outcomes & Program Specific outcomes

Course Outcomes	Program Outcomes												PSO's		
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	2	2											2		
CO2	2	2											2		
CO3	2	2											2		
CO4	2	2											2		
CO5	2	2											2		

1---Low association, 2--- Moderate association, 3---High association

Department: Electronics and Communication Engineering	
Course Title: Linear Integrated Circuits	***Course Code: 20EC410***
Credits (L: T:P): 3:0:1	***Total Contact Hours: 39:0:20***
Type of Course: Integrated Course	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 100***

Course Outcomes: After completing this course, students shall be able to:

CO1:	Explain the operation of linear integrated circuits and explore their applications.
CO2:	Analyze linear integrated circuits to obtain the voltage and current responses at different points and the frequency response.
CO3:	Design a linear integrated circuit for the given specification by applying the concepts of linear integrated circuit.
CO4:	Demonstrate the skill set for a given application / problem statement using linear ICs and EDA tools.

Unit No.	Course Content	No. of Hours
1	**Introduction to Operational Amplifiers and Characteristics:** Introduction, Basic Information of Op-Amp, the ideal Operational Amplifier, Operational amplifier internal circuit, DC and AC characteristics, Inverting and non-inverting amplifiers, voltage follower.	08
2	**Op-Amp Applications I:** Summing Amplifiers**,** Instrumentation amplifier, V to I and I to V Converters, high resistance DC voltmeter, universal high resistance voltmeter, solar cell energy measurements, differentiator, integrator. **Active filters** - RC filters, State Variable filter, switched capacitor filters	10
3	**Op-Amp Applications II:** Comparator**,** Schmitt Trigger, Square/Rectangular and Triangular wave generators, sample and hold circuit, LOG and ALOG amplifiers, multiplier, divider and their applications.	07
4	**Op-Amp Applications III:** Precision rectifiers, peak detectors, dead-zone circuits, A to D and D to A Converters.	06
5	**Voltage Regulators and 555 Timer:** Series op-amp regulator, IC voltage regulator, 723 general purpose regulator, Switching regulators, 555 Timer as Monostable and Astable Multivibrator.	08

Text Books:

1. **James M. Fiore:** "*Operational Amplifiers & Linear Integrated Circuits: Theory and Application"* Version 3.2.6, May 2021.
2. **Robert F Coughlin, Frederick F Driscoll:** "*Operational Amplifiers & Linear Integrated Circuits*", Pearson India education services Pvt. Ltd,2017
3. **D. Roy Choudhary, Shail B. Jain:** "*Linear Integrated Circuits", New Academic Science,* 5th Edition, 2018.

Reference Books:

1. **David A. Bell:** "*Operational Amplifiers and Linear ICs*", 3rd Edition, Oxford university press, India, 2011.
2. **Ramakanth A. Gayakwad:** "*Op-Amps and Linear Integrated Circuits*", 4th Edition, Pearson India education services Pvt. Ltd, 2015
3. **S Rajaram, A Kandaswamy, M Alagappan, Arulalan Rajan,** *"Linear Integrated Circuits and its Applications"*, Texas Instruments

Web Resources:

1. EBook: https://docs.google.com/file/d/0B21HoBq6u9TsbG5WdjNZeGwtMWs/preview
2. Video Lecture: http://nptel.ac.in/courses/108106068/

Course Outcomes	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3														
CO2		3											2		
CO3			3											2	
CO4	3	3	3	3	2	2			2			2			2

1---Low association, 2--- Moderate association, 3---High association

Lab Component

List of Experiments

1. Design and testing of Op-amp DC and AC amplifiers: Inverting amplifier, Non- inverting amplifier and Voltage follower.
2. Design and testing of Op-amp DC circuits: Adder, Subtractor, Difference amplifier, Average.
3. Design and testing of Op-amp integrator and differentiator.
4. Design and testing of Butterworth's Low pass and High pass filters.
5. Design and testing of Band pass and Band Elimination filters.
6. Design and testing of Schmitt Trigger Circuits.
7. Design and testing of Op -Amp Triangular and Rectangular Waveform Generators.
8. Design and testing of Voltage regulator.
9. Design and testing of 555 Timer Astable Multivibrator.
10. Simulation experiments:
    i. State variable and switched capacitor filter
    ii. Switching voltage regulator
    iii. Precision rectifiers
    iv. Instrumentation amplifiers
    v. Amplitude modulation using analog multiplier

    Note: Design and simulate the opamp applications using appropriate tools.

Department: Electronics and Communication Engineering	
Course Title: Microcontrollers and Embedded system	***Course Code: 20EC420***
Credits (L: T:P): 4:0:0	***Total Contact Hours: 52:0:0***
Type of Course: Lecture	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Programming in C and any programming language like Verilog, VHDL.

Course Outcomes: After completing this course, students shall be able to:

CO1:	Explain the basics of Embedded system, architecture of 8051 microcontroller and ARM cortex processor
CO2:	Develop programs using assembly language and embedded C.
CO3:	Design applications using 8051 and ARM Cortex
CO4:	Demonstrate the given problems using technological advancements.

Unit No.	Course Content	No. of Hours
1	**Introduction to Embedded Systems: Introduction to Embedded Systems:** Embedded systems- definition, classification of embedded systems, types of embedded systems, purpose of embedded systems. Elements of embedded systems – cores, firmware, sensors and actuators, bus systems, memory. Embedded SOC and use of VLSI Circuit Design Technology, Formalization of System Design, Design Process and Design Examples.	12
2	**8051 Microcontroller:-** Architecture, 8051 hardware, i/o and o/p pins, ports and port circuits, external memory, counters and timers, serial communication. **Addressing modes & instructions: -** Addressing modes, external data moves, code memory read only data moves, PUSH & POP op-codes, data exchanges, and arithmetic, logical, jump and call instructions.	10
3	**Timer/counter, serial communication and interrupt programming**:- Programming 8051 timer/counter, basics of serial communication, 8051 connection to RS 232, 8051 serial port programming, 8051 interrupts, programming timer interrupts, programming external hardware interrupts, programming serial communication interrupts.	10
4	**Interfacing Applications: -** Interfacing keyboard, LCD, ADC, DAC, Stepper motor & DC motor, 7 segment displays, Elevator.	10
5	**Introduction to ARM Cortex-M processors:** Introduction to ARM cortex-M3, Advantages of the Cortex –M processors, Applications of the ARM cortex-M processors. **Architecture:** Introduction to the architecture, Programmer's model, Behavior of the application program status word. Memory System: Overview of memory system features, Memory map, connecting processor to memory and peripherals **Exception and Interrupts:** Overview of exception and interrupts, Exception types, Overview of interrupt management, Definition of priority, Vector table and vector table relocation, Interrupt inputs and pending behaviors.	12

Text Books:

1. **Kenneth J Ayala :** "*The 8051 Microcontroller Architecture, Programming and Application* " - 2ed Penram International 1996.
2. **Muhammad Ali Mazidi and Janice Gillespie**: "*The 8051 Microcontroller and embedded System"* -Pearson Education 2003.
3. **Joseph You** "The definitive guide to ARM CORTEX-M3 and to ARM CORTEX-M4 processor" Third Edition-Elsevier 2014
4. **Shibu K V**, "Introduction to Embedded Systems", TMH, 2009

Reference Books:

1. **Andrew N. Sloss**, **Dominic Systems and Chris Wright**- "*ARM system developer Guide Designing and Optimizing System Software"* Elsevier 2004.
2. **Raj Kamal,** "Embedded ***Systems Architecture, Programming and Design***" , 2nd Edition, TMH, 2008.

Web Resources:

1. http://infocenter.arm.com/help/topic/com.arm.doc
2. http://www.keil.com
3. https://swayam.gov.in/

Mapping - Course Outcomes with Program outcomes & Program Specific outcomes

Course Outcomes	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1	3												2		
CO2		3												2	
CO3			3												2
CO4	3	3	3	3	3				3	3		3		3	3

1---Low association, 2--- Moderate association, 3---High association

Department: Electronics and Communication	
Course Title: Signals and Systems	***Course Code: 20EC430***
Credits (L: T:P): 3:1:0	***Total Contact Hours: 39:10:0***
Type of Course: Lecture	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Student should be familiar with different types of signals.

Course Outcomes: After completing this course, students should be able to:

CO1:	Explain the different types of signals using knowledge of mathematics.
CO2:	Analyze the properties of signals and system.
CO3:	Design solution to the Differential and difference equations of LTI systems.
CO4:	Demonstrate skill sets related to software tools in the analysis and simulation of signals and systems in group.

Unit No.	Course Content	No. of Hours
1	**Basics of Signals and Systems:** Introduction, Definitions and examples of a signal and a system, Classification of signals, Basic operations on signals, Elementary signals, Systems viewed as interconnection of operations, properties of systems. **Matlab Exercise: Representation of signals**	08
2	**Time Domain Representation of LTI systems:** Introduction, Impulse response characterization and convolution sum for the discrete time LTI systems, Properties of convolution sum, Impulse response characterization and convolution integral for continuous time LTI systems, properties of convolution integral, Interconnection of LTI systems, LTI system properties in terms of impulse response, Step response, Differential and Difference equation representation of LTI systems, Characterization of Systems described by differential or difference equations, Block diagram representation. **Matlab Exercise:** **1. Convolution operation on continuous time and discrete time signals.** **2. Evaluate the response of LTI system using convolution.**	08
3	**Fourier analysis of Continuous time signals and LTI systems:** Introduction, Continuous time Fourier transform (CTFT), properties, Magnitude and Phase spectra, Frequency response of continuous time LTI systems, application of Fourier transform, relating FT to FS, Relationship between LT and FT. **Matlab Exercise: To study the frequency domain representation of continuous time signals.**	07
4	**Fourier analysis of discrete time signals and LTI systems:** Discrete time Fourier transform (DTFT), properties and applications of DTFT, Relating the FT to the DTFT, Relating the FT to the DTFS, Sampling and Reconstruction. Finding inverse Fourier Transforms by using Partial fraction expansions, Parsivals Relationships, Time-Bandwidth Product. Applications of Fourier representations to mixed signal classes: Fourier Transform representations of Periodic signals and discrete time signals, Sampling, Fourier series representations of Finite duration non periodic signals. **Matlab Exercise: To study the frequency domain representation of Discrete time signals.**	08

5	**Z- transforms and Applications:**Introduction to z-transform, ROC and its properties, properties of z- transform, Inverse z-transform, Analysis and characterization of LTI systems using z-transforms, Computational structures for implementing Discrete time LTI systems, Unilateral Z-transforms and their applications for solving difference equations, Relationship between z- , Laplace and DTFTs. **Matlab Exercise:** **1. To find Z-transform of discrete signals and representation of pole-zero plot.** **2. To evaluate response of discrete time LTI systems for different inputs.** **3. Stability analysis of discrete time LTI systems.**	08

Text Books:

1. **Simon Haykin and B. V. Veen,** Signals and Systems, Wiley , Second Edition, 2013.
2. **A. V. Oppenheim, A. S. Willsky and S. H. Nawab**, Signals and Systems, Prentice Hall of India, 2006.
3. **Yang** , signals and systems with MATLAB ,springer internation edition , 2014

Reference Books:

1. **Michael J Roberts ,** "Fundamentals of signals and systems",Tata Mcgraw Hill ,2008.
2. **Ganesh Rao and Satish Tunga**, "Signals and Systems", Sanguine Technical Publishers, 2004
3. **Udaya Kumar S** "Signals and systems" , 7th Edition , pristine publishing House,2017.

Web Resources:

3. https://nptel.ac.in/courses/1171040741.
4. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/
5. NPTEL lecture Video on Signals and Systems by Prof. S.C.Dutta Roy, http://www.satishkashyap.com/2012/04/iit-video-lectures-on-signals-and.html
6. NPTEL lecture Video on Signals and Systems by Prof. T.K. Basu,IIT Kharagpur. http://www.nptel.ac.in/courses/108105065/

Program Articulation Matrix

ASP	Program outcomes												Program specific outcomes		
EC430	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												2		
CO2		3											2		
CO3			3											2	
CO4	3	3	3	3	3	3			3	2		2			2

1---Low association, 2--- Moderate association, 3---High association

Department: Electronics and Communication Engineering	
Course Title: Communication Systems-II	***Course Code: 20EC440***
Credits (L: T:P): 3:0:0	***Total Contact Hours: 39:0:0***
Type of Course: Lecture	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: NIL or list of few subjects studied in previous semesters which makes pre requisite for this course.

Course Outcomes: After completing this course, students should be able to:

CO1:	Describe the importance of digital communication systems
CO2:	Analyze and evaluate the various waveform coding and digital modulation techniques through analytical and simulation methods.
CO3:	Design and demonstrate the performance analysis of optimum receivers for AWGN channel.
CO4:	Demonstrate the working of digital communication system for the given application.

Unit No.	Course Content	No. of Hours
1	**Introduction**: Digital communication system model, modulation process, analog vs. digital communication; Fundamental limitations of communication systems,. Information content of a discrete memory less source (DMS), Information content of a symbol , Entropy , Information rate, DMC, source coding , entropy coding, error control coding, parity coding, vertical redundancy check, linear block codes, Hamming codes, Cyclic codes and convolution codes.	07
2	**Waveform Coding Techniques:** sampling methods and significance of sampling rate Discretization in time and amplitude. Linear quantizer, quantization noise power calculation, signal to quantization noise ratio, non – uniform quantizer, A law & μ law companding encoding and pulse code modulation, bandwidth of PCM, Differential pulse code modulation, Delta modulation, Idling noise and slope overload, Adaptive delta modulation, adaptive DPCM. Comparison of PCM and DM.	08
3	**Digital Modulation Schemes:** Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Minimum Shift Keying (MSK) –Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK – 16 PSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM , Minimum shift keying (MSK) , Gaussian minimum shift keying (GMSK) Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).	08
4	**Digital Baseband Transmission:** Line coding and its properties. NRZ & RZ types, signaling format for uni polar, polar, bipolar, AMI & Manchester coding and their power spectra (No derivation), HDB and B&W signaling, ISI, Nyquist criterion for zero ISI & raised cosine spectrum., impulse response and peak pulse signal to noise, correlation detector decision threshold and error probability for binary Unipolar (on – off), signaling.	08
5	**Performance analysis of digital communication:** Optimum detection for binary signals, optimum receiver analysis, Matched filter receiver and its derivation, coherent receivers for carrier modulation, optimum receiver for AWGN channels.	08

Text Books:

1. **Proakis, J.G and Salehi, M** "Digital Communications", 5th Edition , McGraw-Hill, 2008.
2. **B. P. Lathi,** "Modern digital and analog Communication systems" - 4th edition, Oxford University Press, 2010,

Reference Books:

1. **Simon Haykins,** "Communication Systems"- 5th edition, John Wiley, 2009.
2. **Michael Fitz,** "Fundamentals of Communication Systems", TMH, 2008 (for MATLAB exercises and mini projects)
3. **Roden, M.S,** "Analog and Digital Communication Systems" - 5th edition, Discovery Press, 2005

Web Resources:

1. https://nptel.ac.in/courses
2. https://nptel.ac.in/courses
   1.

Mapping - Course Outcomes with Program outcomes & Program Specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												2		
CO2		3												2	
CO3			3												2
CO4	2	2	2	2	2				2	2		2			2

1---Low association, 2--- Moderate association, 3---High association

Department: Electronics and Communication Engineering	
Course Title: Engineering Electromagnetics	***Course Code: 20EC450***
Credits (L: T:P): 4:0:0	***Total Contact Hours: 52:0:0***
Type of Course: Lecture	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 100***

Course Outcomes: After completing this course, students should be able to:

CO1:	Interpret various types of fields and charge distributions using vector calculus.
CO2:	Analyze Electrostatic and Magnetostatic models.
CO3:	Design the static and time varying fields to determine its behavior in different mediums.
CO4:	Demonstrate the skill sets using modern tools to solve EM problems.

Unit No.	Course Content	No. of Hours
1	Vector Analysis, Co-ordinate System, Coulomb's Law, Electric field intensity, Electric field due to various charge distribution, Electric flux and flux density, Flux density due to various charge distribution, Gauss Law, Applications of Gauss law, Divergence and Maxwell's Equations.	10
2	Work done & Line Integral Concept, Potential, Potential due to various charge distribution, Potential due to infinite line charge, Conservative field, Potential gradient, dipole, Energy density in ES field, Current and current density, Equation of continuity, Conductor & dielectric, Boundary conditions, Concept of capacitance, Energy stored in capacitance, Poisson's & Laplace Equations, calculating capacitance using Laplace's Equations.	11
3	Magnetic field & its properties, Biot Savart's Law, Computation of H using BSL, Ampere's Circuital Law, Computation of H using ASL, Curl & Stokes Theorem, Magnetic flux & flux density, Scalar & Vector Potentials, Magnetic Forces, Boundary conditions for Magnetic Field.	11
4	Introduction to Time Varying fields, Faraday's equations, Displacement current, Field relations for Time Varying Electric & Magnetic fields, Maxwell's Equations, Relation between field and Circuit Theory.	10
5	Uniform plane waves, General equations, UPW in free space & various media, Poynting Theorem, Wave Polarization, Reflection, Refraction, Diffraction of waves, Fundamentals of Antennas and Radiating Ssystems.	10

Self Learning Components: Magnetic Materials, Friss Formula and Radar Equations.

Text Books:

1. **William A Hayt, John A Buck, M Jaleel Akhtar**, "Engineering Electromagnetics", 9th edition, McGraw Hill Publication, 2020.
2. **Matthew N.O. Sadiku, S.V. Kulkarni**, "Principles of Electromagnetics", 6th edition, Pearson Education, 3rd Impression, 2016.

Reference Books:

1. **David K Cheng** "Fundamentals of Engineering Electromagnetics", 2nd edition, Pearson Education Asia, 2019.
2. **Rohit Khurana**, "Electromagnetic Field Theory", 2nd edition, Vikas Publication,2016.
3. **J. A. Edminister**, "Electromagnetics",4th Edition, McGraw Hill Publication, ,2013.
4. **Karl E. Lonngren, Sava V. Savov**, "Fundamentals of Electromagnetics with MATLAB", 2nd edition, SciTech Publications, 2007.
5. **John D kraus, Keith R Carver** "Electromagnetics with applications",6th Edition,McGraw Hill Publications,1998.

E-Resource

1. http://nptel.ac.in/courses/108106073.
2. http://nptel.ac.in/courses/117103065
3. http://ocw.mit.edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6-632Electromagnetic-Wave-TheorySpring2003/CourseHome/Index.htm
4. http://www.plasma.uu.se/CED/Book

Mapping - Course Outcomes with Program outcomes & Program Specific outcomes

EC450	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3		
CO2		3												3	
CO3			3												3
CO4	3	3	3	3	3	2			2	2		2	2	2	2

1---Low association, 2--- Moderate association, 3---High association

Department: Electronics and Communication	
Course Title: Communication Lab -1	***Course Code: 20EC47L***
Credits (L: T:P): 0:0:1.5	***Total Contact Hours: 0:0:39***
Type of Course: Practical	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 50***

Pre-requisite: Communication Systems -I

Course Outcomes: After completing this course, students should be able to:

CO1:	Analyze various analog modulation and demodulation circuits and sampling theorem
CO2:	Design various analog modulation circuits, frequency synthesizers, pre-emphasis and de-emphasis circuits.
CO3:	Demonstrate the working of FDM, PLL, and Sample and hold circuits and its reconstruction.

EXP No.	Course Content	No. of Hours
1.	Amplitude Modulation and Demodulation	3
2.	DSB SC Modulation and Demodulation	3
3.	SSB SC Modulation and Demodulation	3
4.	Frequency Modulation and Demodulation	3
5.	Pre Emphasis - De Emphasis Circuits	3
6.	Verification of Sampling Theorem	3
7.	PAM Generation and Reconstruction	3
8.	PWM Generation and Reconstruction	3
9.	PPM: Generation	3
10.	Frequency division multiplexing	3
11.	Frequency synthesis using phase locked loop (PLL)	3

NOTE: A minimum of 10(Ten) experiments must be performed and recorded by the candidate to attain eligibility for University Practical Examination

Text Books:

1. **Wayne Tomasi** – "Electronic Communication Systems" 5th edition, Pearson Education, 2007
2. **B. P. Lathi** "Modern digital and analog Communication systems", 4th edition, Oxford University Press, 2010,

Mapping - Course Outcomes with Program outcomes & Program Specific outcomes

EC450	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3													
CO2			3												
CO3		3	3		3				2	2		2		3	2

Department: Electronics and Communication	
Course Title: Microcontrollers and Embedded system Lab	***Course Code: 20EC48L***
Credits (L: T:P): 0:0:1.5	***Total Contact Hours: 0:0:39***
Type of Course: Practical	***Category: Professional Core Course***
CIE Marks: 50	***SEE Marks: 50***

Course Outcomes: After completing this course, students should be able to:

CO1:	Design interfacing simple peripheral devices to a Microcontroller.
CO2:	Demonstrate the working of simple peripheral devices using Microcontroller and embedded system.

EXP No.	Course Content	No. of Hours
SET1: Software programs: Problems to be implemented on 8051 microcontroller		
1.	Problems related with data transfer and exchange.	3
2.	Problems related with arithmetic and logical operations.	3
3.	Problems related with programming timers in all modes with and without interrupts.	3
4.	Problems related with programming serial communication with and without interrupts.	3
5.	Program related with handling external interrupts.	3
Set2: Hardware programs: To be implemented on 8051 and ARM CORTEX-M3 (using Embedded C)		
6.	Interface LCD.	3
7.	Interfacing of matrix keypad.	3
8.	Interfacing of ADC and DAC.	3
9.	Interfacing of multi digit 7 segment displays.	3
10.	Interfacing of stepper motor and D C motor.	3

Text Books:

1. **Kenneth J Ayala :** "*The 8051 Microcontroller Architecture, Programming and Application* " - 2ed Penram International 1996.
2. **Muhammad Ali Mazidi and Janice Gillespie** : "*The 8051 Microcontroller and embedded Systems-*" '-Pearson Education 2003.
3. **Joseph Yiu** *'The definitive guide to ARM CORTEX-M3 and to ARM CORTEX-M4* processor' Third Edition-Elsevier 2014

E -resources

1. **http://infocenter.arm.com/help/topic/com.arm.doc**
2. **http://www.keil.com**

Mapping - Course Outcomes with Program outcomes & Program Specific outcomes

Course Outcomes	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3
CO1			3										3		
CO2	3	3	3	3	3	2			2	2		2	2	2	3

1---Low association, 2--- Moderate association, 3---High association