P.S.R. ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Sevalpatti (P.O), Sivakasi – 626140.

B.E. Electronics and Communication Engineering

CURRICULUM
AND
SYLLABI

U.G
Regulations 2019

Department of
Electronics and Communication Engineering

CANDIDATES ADMITTED DURING 2019-2020 AND ONWARDS

INSTITUTE VISION AND MISSION

VISION

To contribute to the society through excellence in technical education with societal values and thus a valuable resource for industry and the humanity.

MISSION

- To create an ambience for quality learning experience by providing sustained care and facilities.
- To offer higher level training encompassing both theory and practices with human and social values.
- To provide knowledge based services and professional skills to adapt tomorrow's technology and embedded global changes.

DEPARTMENT VISION AND MISSION

VISION

- The vision of the Electronics and Communication Engineering Department is to produce graduates with sound knowledge for the betterment of society and to meet the dynamic demands of industry and research.

MISSION

- Offering under graduate and post graduate programmes by providing effective and balanced curriculum and equip themselves to gear up to the ethical challenges awaiting them
- Providing the technical, research and intellectual resources that will enable the students to have a successful career in the field of electronics and communication engineering.
- Providing need based training and professional skills to satisfy the needs of society and industry.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. Lead a professional career by acquiring the basic knowledge in the field of specialization and allied Engineering.
2. Assess the real life problems and deal with them confidently relevance to the society.
3. Engage in lifelong learning by pursuing higher studies and participating in professional organizations.
4. Exhibit interpersonal skills and able to work as a team for success.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Design, simulate and analyze diverse problems in the field of telecommunication.
2. Able to design and analyze varied electronic circuits for applications.
3. Apply signal and image processing techniques to analyze a system for applications.
4. Construct, test and evaluate an embedded system and control systems with real time constraints.

PROGRAMME OUTCOMES (POs)

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design / Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in 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. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:**Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Department: Electronics and Communication Engineering

	Theory Courses					Theory Cum Practical	Practical Courses			Institution Non-credit Courses	Value AddedCourses / Mandatory Courses	Total Credits
I	191HS11-Communicative English (2)	191HS12-Calculus and Linear Algebra(4)	191HS13-Engineering Physics (2)	191HS14-Engineering Chemistry (2)	191EEF1- Basic Electrical and Electronics Engineering(3)	191MEF1-Engineering Graphics(3)	191HS17-Physics & Chemistry Laboratory - I (1)	191EEF7-Basic Electrical and Electronics Laboratory(1)	-	-	-	18
2	191HS21-Technical English (2)	191HS22-Differential Equations and Numerical Methods (4)	191HS23-Physics of Materials (2)	191HS24-Environmental Science (2)	191CSF1-Programming for Problem Solving(3)	191MEF7-Mechanical Workshop (3)	191HS27-Physics & Chemistry Laboratory – II(1)	191CSF7-C Programming Laboratory(1)	-	-	-	18
3	191HS31-Transforms and Discrete Mathematics(3)	191BS31-Biology for Engineers (3)	191EC31-Circuits and Electronic Devices(4)	191EC32-Linear Integrated Circuits (3)	191EC33-Networks and Transmission lines(3)	191CS35 Data Structures and C++ (4)	191EC37-Circuits and Devices Laboratory(1)	191EC38-Linear Integrated Circuits Laboratory(1)	-	191HS37 – Communication Skills - I	VAC - I	22
4	191HS41-Probability and Random Processes(3)	191EC41-Analog Electronics (3)	191EC42-Signals and Systems (4)	191EC43-Digital Systems (3)	191EC44-Electromagnetic Fields and waveguides (4)	191CS46-Python Programming (4)	191EC47-Analog Electronics Laboratory(1)	191EC48-Digital System Laboratory(1)	-	191HS47 – Communication Skills - II	MC- I	23
5	191EC51-Analog and Digital Communication (3)	191EE42-Control Systems (3)	191EC52-Antennas and Microwave Engineering (3)	191EC53-Digital Signal Processing and Architecture(4)	PE 1(3)	191EC54-Embedded Systems and IOT (4)	191EC57-Communication Systems Laboratory(1)	191EC58-DSP and Signal Processors Laboratory(1)	-	191HS57 – Business English	VAC - II	22
6	191EC61-Wireless Communication (3)	191EC62-Machine Learning (3)	191EC63-Data Communication Networks (3)	PE2 (3)	OE 1(3)	191EC64 – VLSI Design (4)	191EC67-Machine Learning Laboratory(1)	191EC68-Networks Laboratory(1)	191EC69-Mini Project (1)	191HS67 – Career English	MC - II	22
7	191EC71-Robotics and Artificial Intelligence (3)	191EC72-Digital Image Processing (3)	Elective (Management)(3)	PE3(3)	OE2(3)	191EC73-Fiber Optic Communication and Networks(4)	191EC77-Robotics and Artificial Intelligence Laboratory(1)	191EC78-Digital Image Processing Laboratory(1)	191EC79-Project Work-I(2)	-	VAC - III	23
8	PE 4 (3)	PE 5 (3)		-	-		191EC89-Project Work - II(6)			-	-	12
Total Number of Credits												**160**

P.S.R. ENGINEERING COLLEGE, SIVAKASI –626140.
UG REGULATIONS –2019
B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
CURRICULUM [I –VIII SEMESTER]

SEMESTER I

S.No	Course Code	Name of the Course	Category	L-T-P	Credit
1	191HS11	Communicative English	HSMC	2-0-0	2
2	191HS12	Calculus and Linear Algebra	BSC	3-1-0	4
3	191HS13	Engineering Physics	BSC	2-0-0	2
4	191HS14	Engineering Chemistry	BSC	2-0-0	2
5	191EEF1	Basic Electrical and Electronics Engineering	ESC	3-0-0	3
6	191MEF1	Engineering Graphics(Theory Cum Practical)	ESC	1-0-4	3
7	191HS17	Physics and Chemistry Laboratory-I	BSC	0-0-2	1
8	191EEF7	Basic Electrical and Electronics Laboratory	ESC	0-0-2	1
		TOTAL		**22**	**18**

SEMESTER II

S.No	Course Code	Name of the Course	Category	L-T-P	Credit
1	191HS21	Technical English	HSMC	2-0-0	2
2	191HS22	Differential Equations and Numerical Methods	BSC	3-1-0	4
3	191HS23	Physics of Materials	BSC	2-0-0	2
4	191HS24	Environmental Science	BSC	2-0-0	2
5	191CSF1	Programming for Problem Solving	ESC	3-0-0	3
6	191MEF7	Mechanical Workshop (Theory Cum Practical)	ESC	1-0-4	3
7	191HS27	Physics and Chemistry Laboratory-II	BSC	0-0-2	1
8	191CSF7	C Programming Laboratory	ESC	0-0-2	1
		TOTAL		**22**	**18**

SEMESTER III

S.No	Course Code	Name of the Course	Category	L-T-P	Credit
1	191HS31	Transforms and Discrete Mathematics	BSC	2-1-0	3
2	191BS31	Biology for Engineers (Common to all except Biotech)	BSC	3-0-0	3
3	191EC31	Circuits and Electronic Devices	PC	3-1-0	4
4	191EC32	Linear Integrated Circuits (Common to ECE,BME &EEE)	PC	3-0-0	3
5	191EC33	Networks and Transmission lines	PC	3-0-0	3
6	191CS35	Data structures and C++(Theory cum Practical)(Common to ECE & BME)	ESC	3-0-2	4
7	191EC37	Circuits and Devices Laboratory	PC	0-0-2	1
8	191EC38	Linear Integrated Circuits Laboratory	PC	0-0-2	1
9	191HS37	Communication Skills - I	HSMC	0-0-2	0
		TOTAL		**27**	**22**

SEMESTER IV

S.No	Course Code	Name of the Course	Category	L-T-P	Credit
1	191HS41	Probability and Random Processes	BSC	2-1-0	3
2	191EC41	Analog Electronics	PC	3-0-0	3
3	191EC42	Signals and Systems(Common to ECE &BME)	PC	3-1-0	4
4	191EC43	Digital Systems	PC	3-0-0	3
5	191EC44	Electromagnetic Fields and waveguides	PC	3-1-0	4
6	191CS46	Python Programming(Theory cum Practical)	ESC	3-0-2	4
7	191EC47	Analog Electronics Laboratory	PC	0-0-2	1
8	191EC48	Digital Systems Laboratory	PC	0-0-2	1
9	191HS47	Communication Skills – II	HSMC	0-0-2	0
		TOTAL		**28**	**22**

SEMESTER V

S.No	Course Code	Name of the Course	Category	L-T-P	Credit
1	191EC51	Analog and Digital Communication	PC	3-0-0	3
2	191EE42	Control Systems (Common to ECE & EEE)	PC	3-0-0	3
3	191EC52	Antennas and Microwave Engineering	PC	3-0-0	3
4	191EC53	Digital Signal Processing and Architecture (Common to ECE & BME)	PC	3-1-0	4
5	-	Elective I* (PE1)	PE	3-0-0	3
6	191EC54	Embedded Systems and IOT (Theory cum Practical)	PC	3-0-2	4
7	191EC57	Communication Systems Laboratory	PC	0-0-2	1
8	191EC58	DSP and Signal Processors Laboratory	PC	0-0-2	1
9	191HS57	Business English	HSMC	0-0-2	0
		TOTAL		**27**	**22**

SEMESTER VI

S.No	Course Code	Name of the Course	Category	L-T-P	Credit
1	191EC61	Wireless Communication	PC	3-0-0	3
2	191EC62	Machine Learning	PC	3-0-0	3
3	191EC63	Data Communication Networks	PC	3-0-0	3
4	-	Elective II* (PE2)	PE	3-0-0	3
5	-	Elective III* (OE1)	OE	3-0-0	3
6	191EC64	VLSI Design (Theory cum Practical)	PC	3-0-2	4
7	191EC67	Machine Learning Laboratory	PC	0-0-2	1
8	191EC68	Networks Laboratory	PC	0-0-2	1
9	191EC69	Mini Project	PROJ	0-0-2	1
10	191HS67	Career English	HSMC	0-0-2	0
		TOTAL		**28**	**22**

SEMESTER VII

S.No	Course Code	Name of the Course	Category	L-T-P	Credit
1	191EC71	Robotics and Artificial Intelligence	PC	3-0-0	3
2	191EC72	Digital Image Processing (Common to CSE & ECE)	PC	3-0-0	3
3	-	Elective (Management)	HS	3-0-0	3
4	-	Elective IV* (PE3)	PE	3-0-0	3
5	-	Elective V* (OE2)	OE	3-0-0	3
6	191EC73	Fiber Optic Communication and Networks (Theory Cum Practical)	PC	3-0-2	4
7	191EC77	Robotics and Artificial Intelligence Laboratory	PC	0-0-2	1
8	191EC78	Digital Image Processing Laboratory	PC	0-0-2	1
9	191EC79	Project - I	PROJ	0-0-4	2
		TOTAL		**28**	**23**

SEMESTER VIII

S.No	Course Code	Name of the Course	Category	L-T-P	Credit
1	-	Elective VI* (PE4)	PE	3-0-0	3
2	-	Elective VII* (PE5)	PE	3-0-0	3
3	191EC89	Project - II	PROJ	0-0-12	6
		Total		**18**	**12**

PROGRAMME ELECTIVES

S.No	Course Code	Name of the Course	Category	L-T-P	Credit
1.	191ECEA	CMOS Analog IC Design	PE	3-0-0	3
2.	191ECEB	Cognitive Radio	PE	3-0-0	3
3.	191ECEC	Cryptography and Network Security (Common to ECE & BME)	PE	3-0-0	3
4.	191ECED	Cyber Security	PE	3-0-0	3
5.	191ECEE	Edge Computing	PE	3-0-0	3
6.	191ECEF	Electromagnetic Compatibility	PE	3-0-0	3
7.	191ECEG	Electronic Product Design	PE	3-0-0	3
8.	191ECEH	Low Power SoC Design	PE	3-0-0	3
9.	191ECEI	MEMS and NEMS	PE	3-0-0	3
10.	191ECEJ	Mobile Robotics	PE	3-0-0	3
11.	191ECEK	Mixed Signal IC Design	PE	3-0-0	3
12.	191ECEL	Photonic Networks	PE	3-0-0	3
13.	191ECEM	PLC and Automation	PE	3-0-0	3
14.	191ECEN	Quantum Computing	PE	3-0-0	3
15.	191ECEO	Wearable Electronics	PE	3-0-0	3
16.	191ECEP	Satellite Communication	PE	3-0-0	3
17.	191ECEQ	Satellite Remote Sensing and Data Analysis	PE	3-0-0	3
18.	191ECER	Smart Radar Systems	PE	3-0-0	3
19.	191ECES	Smart Structures And Smart Materials	PE	3-0-0	3

20.	191ECET	Video Analytics	PE	3-0-0	3
21.	191ECEU	Virtual Reality and Augmented Reality (Common to ECE & BME)	PE	3-0-0	3
22.	191ECEV	RFID and its Applications	PE	3-0-0	3

OPEN ELECTIVES

OPEN ELECTIVES OFFERED BY DEPARTMENT OF ECE					
S.No	**Course Code**	**Name of the Course**	**Category**	**L-T-P**	**Credit**
1.	191OE2A	Agriculture Electronics	OE	3-0-0	3
2.	191OE2B	Consumer Electronics	OE	3-0-0	3
3.	191OE2C	Medical Electronics	OE	3-0-0	3
4.	191OE2D	Multimedia Compression And Communication	OE	3-0-0	3

OPEN ELECTIVES OFFERED BY DEPARTMENT OF CSE					
S. No.	**Course Code**	**Name of the Course**	**Category**	**L-T-P**	**Credit**
1.	191OE1A	Green Computing	OE	3–0–0	3
2.	191OE1B	Java Scripts	OE	3–0–0	3
3.	191OE1C	Python Foundations	OE	3–0–0	3
4.	191OE1D	Web Development using PHP	OE	3–0–0	3

OPEN ELECTIVES OFFERED BY DEPARTMENT OF EEE					
S. No.	**Course Code**	**Name of the Course**	**Category**	**L-T-P**	**Credit**
1	191OE4A	Domestic and Industrial Electrical Installation	OE	3–0–0	3
2	191OE4B	Electrical Materials	OE	3–0–0	3
3	191OE4C	Energy Auditing and Conservation	OE	3–0–0	3
4	191OE4D	Energy Storage Systems	OE	3–0–0	3
5	191OE4E	Renewable and Sustainable Energy	OE	3-0-0	3
6	191OE4F	Vehicular Electric Power System	OE	3-0-0	3

OPEN ELECTIVES OFFERED BY DEPARTMENT OF BIO-TECHNOLOGY					
S. No.	**Course Code**	**Name of the Course**	**Category**	**L-T-P**	**Credit**
1	191OE5A	Biomaterials	OE	3–0–0	3
2	191OE5B	Biosensors	OE	3–0–0	3
3	191OE5C	Bioweapons and Security	OE	3–0–0	3
4	191OE5D	Food and Nutrition Technology	OE	3–0–0	3

OPEN ELECTIVES OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING					
S. No	**Course Code**	**Name of the Course**	**Category**	**L-T-P**	**Credit**
1.	191OE6A	Maintenance Engineering	OE	3–0–0	3
2.	191OE6B	Non-Destructive Testing and Materials	OE	3–0–0	3
3.	191OE6C	Operations Research and Management	OE	3–0–0	3

4.	191OE6D	Renewable Sources of Energy	OE	3–0–0	3
5.	191OE6E	Robotics	OE	3–0–0	3

OPEN ELECTIVES OFFERED BY DEPARTMENT OF CIVIL ENGINEERING					
S. No.	**Course Code**	**Name of the Course**	**Category**	**L-T-P**	**Credit**
1	191OE7A	Air and Noise Pollution Control	OE	3–0–0	3
2	191OE7B	Energy Science and Engineering	OE	3–0–0	3
3	191OE7C	Environment and Ecology	OE	3–0–0	3
4	191OE7D	Fundamentals of Fire Safety	OE	3–0–0	3

OPEN ELECTIVES OFFERED BY DEPARTMENT OF BIOMEDICAL ENGINEERING					
S. No.	**Course Code**	**Name of the Course**	**Category**	**L-T-P**	**Credit**
1	191OE8A	Brain Computer Interface and its Applications	OE	3–0–0	3
2	191OE8B	Internet of Things in Medicine	OE	3–0–0	3
3	191OE8C	Speech Processing	OE	3–0–0	3
4	191OE8D	Telehealth Technology	OE	3–0–0	3

MANAGEMENT ELECTIVES OFFERED BY THE DEPARTMENT OF MBA					
S.No.	**Course Code**	**Name of the Course**	**Category**	**L-T-P**	**Credit**
1	191BAEA	Engineering Economics and Accounting	HS	3-0-0	3
2	191BAEB	Entrepreneurship	HS	3-0-0	3
3	191BAEC	Essentials of Management	HS	3-0-0	3
4	191BAED	Intellectual Property Rights	HS	3-0-0	3
5	191BAEE	Professional Ethics in Engineering	HS	3-0-0	3
6	191BAEF	Women Studies and Women Empowerment	HS	3-0-0	3

MANDATORY COURSES					
S.No.	**Course Code**	**Name of the Course**	**Category**	**L–T–P**	**Credit**
1	191MC01	Design Thinking	MC	2–0–0	0
2	191MC02	Essence of Indian Traditional Knowledge	MC	2–0–0	0
3	191MC03	Indian Constitution	MC	2–0–0	0
4	191MC04	Universal Human Values	MC	2–0–0	0
5	191MC05	Yoga	MC	2–0–0	0

CURRICULUM STRUCTURE

S.No	Course Categories	Total Number of Credits PSREC ECE (160)		Total Number of Credits AICTE (160)	
		Credit Distribution	% of weightage of Credits(%)	Credit Distribution	% of weightage of Credits(%)
1.	HSMC - Humanities and Science including management	7	4.38	12	7.5
2.	BSC - Basic Sciences	27	16.88	25	15.63
3.	ESC - Engineering Sciences	22	13.75	24	15
4.	PC – Programme Core	74	46.25	48	30
5.	PE - Programme Elective	15	9.38	18	11.25
6.	OE - Open Elective (OE)	6	3.75	18	11.25
7.	PROJ - Project	9	5.63	15	9.38
8.	Mandatory Courses (MC)	Non Credit Courses			

191HS11	COMMUNICATIVE ENGLISH	L-T-P	C
		2-0-0	2

Programme: **B.E./B.Tech. (Common to all Branches)** **Sem: 1** **Category: HSMC**

Aim: To acquire basic Language skills in order to communicate with English Language Speakers.

Course Outcomes:

The Students will be able to

CO1: Develop the basic reading and writing skills. (AP)
CO2: Listen actively and grasp the contents of the speech.(UN)
CO3: Develop their speaking skills and speak fluently in real contexts. (AP)
CO4: Develop vocabulary of a general kind by developing their reading skills. (AP)
CO5: Use the grammar effectively to exhibit their speaking and writing skill. (AP)
CO6: Speak in English with clarity.(AP)

SHARING INFORMATION RELATEDTO ONESELF, FAMILY AND FRIENDS. 9

Reading – Short comprehension passages, Practice in skimming and scanning. **Writing –** Sentence structures, Developing Hints. **Listening–** Short texts, Short formal and informal conversations. **Speaking** – Introducing oneself, Exchanging personal information. **Language Development** – WH questions, Asking and answering YES or NO questions, Parts of Speech. **Vocabulary Development –** Prefixes & Suffixes, Subject verb Agreement.

GENERAL READING AND FREE WRITING 9

Reading – **Comprehension** – Pre-reading & Post-reading. Comprehension questions (Multiple choice questions, Short questions, Open-ended questions), Short narratives and Descriptions from Newspapers including Dialogues. **Writing –** Paragraph writing, Use of Phrases and Clauses in sentences, Listening Telephonic conversations. **Speaking** – Sharing information of a personal kind, Greetings.

Language Development – Noun Pronoun agreement. **Vocabulary Development** – The Concept of Word Formation. (Norman Lewis' *Word Power Made Easy*)

GRAMMAR AND LANGUAGE DEVELOPMENT 9

Reading – Short texts & Longer passages (Cloze reading). **Writing** – Importance of proper punctuation, Jumbled sentences. **Listening –** Listening to longer texts and filling up the table, Product description, Narratives from different sources. **Speaking –** Asking about routine actions and Expressing opinions.

Language Development – Degrees of Comparison, Pronouns. **Vocabulary Development –** Misplaced modifiers, Relative clauses.

READING AND LANGUAGE DEVELOPMENT. 9

Reading- Comprehension. **Reading** longer texts- reading different types of texts. **Writing**- letter Writing, informal or personal letters-Achieving Coherence. **Listening**- listening to dialogues or conversations and completing exercises based on them. **Speaking**- Speaking about oneself- Speaking about one's friend. **Language Development**- Articles. **Vocabulary Development** – Root words from foreign languages and their use in English.

EXTENDED WRITING **9**

Reading- Longer texts- close reading. **Writing**- Organizing principles of paragraphs in documents. **Listening** – Listening to talks, conversations. **Speaking** – Participating in conversations, short group conversations. **Language Development** - Cliches, Tenses. **Vocabulary Development** - Prepositions.

Total Periods: 45

Text books:

1. Board of Editors. *Fluency in English: A course book for Engineering and Technology*. Orient Blackswan, Hyderabad: 2016.
2. Kumar, Sanjay and Pushp Lata. *Communication Skills: A Workbook*. New Delhi: OUP, 2018

References:

1. www.oxfordonlineenglish.com
2. www.ielts.up.com
3. www.ted.com
4. www.testpreppractice.com
5. www.beccambridgeenglish.org

Extensive Reading

1. Shiv Khera, You Can Win, Macmillan Books, New Delhi, 2003.

Course Outcomes	ProgramOutcomes(POs)												ProgramSpecific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1												2				
CO2								1								2
CO3										3				1		
CO4								1								
CO5									2						3	
CO6										2						

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191HS12 CALCULUS AND LINEAR ALGEBRA L-T-P C
3-1-0 4

Programme: **B.E./B.Tech. (Common to all Branches)** **Sem: 1** **Category: BSC**

Aim: The course is aimed at developing the basic mathematical skills of engineering students,

Course Outcomes: The students will be able to

CO1: Find the inverse and the positive powers of a square matrix (AP)

CO2: Apply the concept of orthogonal reduction to diagonalise the given matrix (AP)

CO3: Determine the evolute of curves, Beta and Gamma Functions (AP)

CO4: Apply Lagrangian multiplier method for finding maxima and minima of an unconstrained Problem (AP)

CO5: Apply the concepts of Differentiation and Integration in Vectors (AP)

CO6: Predict an analytic function, when its real or Imaginary part is known (CR)

MATRICES **12**

Characteristic equation - Eigen Values and Eigen vectors of a real matrix - Properties of Eigen values - Cayley-Hamilton Theorem (without proof) and its application - Orthogonal Transformation of a Symmetric matrix to diagonal form - Quadratic form - Orthogonal reduction to canonical form.

CALCULUS **12**

Radius of Curvature - Cartesian and Parametric Coordinates - Circle of Curvature - Involutes and Evolutes –Beta and Gamma functions and their properties.

MULTIVARIABLE CALCULUS **12**

Partial Derivatives - Total Derivative - differentiation of Implicit function – Jacobian - Taylor's Expansion - Maxima/Minima for function of two variables - Method of Lagrange's multipliers.

VECTOR CALCULUS **12**

Gradient, Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepiped.

COMPLEX VARIABLE – DIFFERENTIATION **12**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy– Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function(without proof) – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w = z + c, cz, 1/z, and bilinear transformation.

Total Periods 60

Text books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th edition, Pearson, Reprint, 2002.

References:

1. Veerarajan.*T.*, "**Engineering Mathematics for first year**", Fourth Edition, Tata Mc-Graw – Hill, New Delhi, 2008.
2. Erwin *Kreyszig*, **Advanced Engineering Mathematics**, 9th Edition, John Wiley & Sons, 2006.
3. G.B. Thomas and R.L. Finney, "**Calculus and Analytic Geometry**" 9th Edition, Pearson,

Reprint,2002.

4. N.P. Bali and Manish Goyal, "**A text book of Engineering Mathematics**", Laxmi Publications, Reprint, 2008.
5. B.S. Grewal, "**Higher Engineering Mathematics**", Khanna Publishers, 36th Edition, 2010.

Course Outcomes	ProgramOutcomes(POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO24	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3		1								3		2	1	
CO2	2	3		3								2				1
CO3	3	3										2	2			
CO4	1	1													2	
CO5	3	2		2										2		
CO6	2	2		1								3	2			2

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191HS13	ENGINEERING PHYSICS	L-T-P	C
		2-0-0	2

Programme: **B.E./B.Tech. (Common to all Branches)** **Sem: 1** **Category:** **BSC**

AIM: To endow the students with the fundamentals of Physics and apply new ideas in the field of Engineering and Technology.

Course Outcomes:

The Students will be able to

CO1: Understand the theory and various crystal structures (UN)

CO2: Know about the basic configuration of a Laser, types of lasers and the industrial applications of Laser (RM)

CO3: Understand principle behind fiber optic communication and the electronic devices involved in the transmission and reception of data (UN)

CO4: Know about basics of properties of matter and its applications (RM)

CO5: Gain knowledge about basic equations of Quantum mechanics and its applications (UN)

CO6: Understand the basic concepts of acoustics and ultrsonics (UN)

SOLID STATE PHYSICS **9**

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Crystal Defects-point, Line and surface defects - burger vector.

WAVE OPTICS **9**

LASERS: Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion, pumping. Einsteins A and B coeffcients – Derivation- Types of lasers – CO_2, Nd-YAG - Industrial Applications - Lasers in welding, cutting and Soldering

FIBER OPTICS: Optical Fiber-Classification- Principle and propagation of light in optical fibres-Numerical aperture and Acceptance angle-Fibre optical communication system- Sensors (Active and passive) –Displacement and Temperature Sensors.

PROPERTIES OF MATTER **9**

Elasticity–Stress - strain diagram and its uses -factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple- torsion pendulum: theory and experiment -bending of beams -bending moment –cantilever: theory and experiment–uniform and non-uniform bending: theory and experiment – I shaped girders - stress due to bending in beams.

QUANTUM PHYSICS **9**

Black body radiation – Planck's theory -Photoelectric effect - Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box.

ACOUSTICS AND ULTRASONICS **9**

ACOUSTICS: Classification of sound - loudness and intensity - Weber-Fechner Law - standard intensity and intensity level - decibel - reverberation - reverberation time - Sabine's formula - absorption coefficient and its determination – factors affecting acoustics of buildings : focusing, interference, echo, Echelon effect, resonance - noise and their remedies

Ultrasonics: Ultrasonics - production - magnetostriction and piezoelectric methods - acoustic grating - industrial applications - NDT.

Total Periods: 45

Text books:

1. Gaur R. K., Gupta S. C., "Engineering Physics" Dhanpat Rai Publications, New Delhi (2016)
2. Avadhanulu M. N., Kshirsagar, P. G., "A Text book of Engineering Physics", S.Chand and company, Ltd., New Delhi, 2017.

References:

1. Serway and Jewett., "Physics for Scientists and Engineers with Modern Physics",6th Edition, Thomson Brooks/Cole, Indian reprint (2016)
2. Arither Beiser, Concepts of Modern Physics, Tata Mc Graw Hill, New Delhi (2015)

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	1	2						3				2	1		3
CO2	2	3	1		2	1			1			2	1		1	1
CO3	2	1	2		1	1	2			1			2	1		3
CO4	2	3	1	1	3								1		2	1
CO5	1	1		2										2		1
CO6	1	2	3	1	1	2	3						2		1	

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191HS14 ENGINEERING CHEMISTRY L-T-P C
2-0-0 2

Programme: **B.E./B.Tech. (Common to all Branches)** **Sem: 1** **Category: BSC**

Aim: To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

Course Outcomes:

At the end of the course the student will be able to

CO1: Demonstrate the essential concept of water and their properties and applications (UN)
CO2: Understand the treatment of water for potable and industrial purposes (UN)
CO3: Understand the operating principles and the reaction involved in electrochemistry (UN)
CO4: Know the principles and application of spectroscopy (UN)
CO5: Learn the basic ingredients required for paint formulation (UN)
CO6: Know the preparation techniques of consumer products (UN)

WATER TECHNOLOGY **9**

Hardness-Types and Estimation by EDTA method- alkalinity –types of alkalinity and determination -Domestic water treatment –disinfection methods – Boiler feed water– internal conditioning– external conditioning – desalination and reverse osmosis.

ELECTROCHEMISTRY **9**

Electrochemical cells – reversible and irreversible cells – EMF –measurement of emf – Single electrode potential – Nernst equation– reference electrodes –Standard Hydrogen electrode –Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series

SPECTROSCOPIC TECHNIQUES AND APPLICATIONS **9**

Introduction of UV-Visible and IR spectroscopy and selection rules- principles and instrumentation of UV-Visible (electronic) spectroscopy – IR (vibrational) spectroscopy - its applications. Fluorescence spectroscopy and its applications in medicine-colorimetry – estimation of iron by colorimetry.

INORGANIC & ORGANIC COATINGS **9**

Paint–Definition–Components of Paints and their functions–Varnish–Definition–Preparation of Oil Varnish–Differences between Paint and Varnish–Special Paints–Luminescent Paints, Fire Retardant Paints- Aluminium Paints - Distemper. corrosion control– electroplating (Au) and electroless (Ni) plating.

PREPARATION OF CONSUMER PRODUCTS **9**

Washing Powder- Cleaning powder-phenoyls (white, Black & coloured)-Shampoo-liquid blue-inks-blue –red-green inks – Soap - bathing & detergent – oils-Face powder and bleaching powder.

Total Periods: 45

Text books:

1. P. Kannan, A. Ravikrishnan, “Engineering Chemistry”, Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009.
2. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002)

References:

1. S.S. Dara, S.S. Umare, “Engineering Chemistry”, S. Chand & Company Ltd., New Delhi 2010.
2. B.K.Sharma, “Engineering chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. B.Sivasankar, “Engineering chemistry” Tata McGraw Hill Publishing Company (P) Ltd., New Delhi, 2006

Course Outcomes	ProgramOutcomes(POs)												Program Specific Outcomes (PSOs)			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	2		1	1	1	1				2	2	2	1		1
CO2	2	2	1	2	1	2	1				1	1		1		2
CO3	2	1	1	2	2							2		1		
CO4	2	2	1		1						2	1			2	
CO5	2	2	1		1	1						2				2
CO6	2	2	1	1	2	1			1	1	1	1			2	

Enter correlation levels1,2or3asdefined below:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191EEF1 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L-T-P C

3-0-0 3

Programme: B.E – Electronics and Communication Engineering **Sem: 1 Category ESC**

Aim: To provide comprehensive idea about AC and DC circuit analysis, working principles and applications of basic machines in electrical engineering and protection schemes in power system.

Course Outcomes:

The Students will be able to

CO1: Analyze DC circuits using basic laws (AN)

CO2: Analyze AC circuits using basic laws (AN)

CO3: Understand the operation of DC machines and its applications (AN)

CO4: Demonstrate about AC machines and its applications (UN)

CO5: Know the construction, working and characteristics of the semiconductor devices (UN)

CO6: Design basic combinational and sequential logic circuits (AP)

ELECTRICAL CIRCUITS & MEASUREMENTS **12**

Ohm's Law – Kirchhoff's Laws –Reduction of series and parallel circuits-Mesh and Nodal Analysis of DC circuits – Introduction to AC Circuits - RMS Value, Average value, Form factor and peak factor phasor representation – Single Phase AC series circuits with R, RL, RC -Power and Power factor. Introduction to three phase circuits- Star and delta connected balanced load.

DC MACHINES & TRANSFORMER **8**

DC Generators - construction, principle of operation, Types, EMF equations and applications. DC Motors - operation, Types, Speed and torque equation – speed control of DC shunt motors. Single Phase Transformer - Constructional details and operation, Types, EMF equation, transformation ratio.

AC MACHINES **8**

Single phase induction motor - construction, operation and applications - Three phase induction motor – Types, Construction and operation, Torque equation, slip torque characteristics, Synchronous generators - construction and operation, EMF equation - Synchronous motors – principle of operation.

9

SEMICONDUCTOR DEVICES

Introduction to semiconductors-PN Junction Diode – characteristics, breakdown effect and applications - Half wave and Full wave rectifiers, Zener Diode - characteristics and voltage regulator. Bipolar Junction Transistor – operation of NPN and PNP, characteristics of CB, CE, CC configurations.

DIGITAL ELECTRONICS **8**

Number System – Binary, octal, hexadecimal, Logic Gates (AND, OR,NOT,NAND,NOR,XOR,XNOR), Half and Full Adders – Flip-Flops –RS, JK, T and D - Counters – synchronous up counter, synchronous down counter, asynchronous up counter, asynchronous down counter, shift registers – shift right and shift left register.

Total Periods 45

Text Books

1. Muthusubramanian R, Salivahanan S, "Basic Electrical, Electronics and Computer Engineering", McGraw Hill, New Delhi, 2009.

2. B L Theraja, AK Theraja,'A Text book of Electrical Technology: Volume 2 AC and DC Machines', S.Chand; Twenty Third edition, 2006.

References

1. V N Mittle, Arvind Mittle "Basic Electrical Engineering", McGraw Hill, New Delhi, 2005.
2. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford University press (2012).
3. V K Mehta, Rohitmehta "Principles of Electronics", S.Chand& Company Ltd, (2015).
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, (2014).
5. R.S. Sedha, "A Textbook of Applied Electronics" S. Chand & Co., 2008.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	1							3		3	3	2	3
CO2	3	2									2		3	2	1	3
CO3	3	3		1							2		3	2		3
CO4	3	2									2		3	3	2	3
CO5	3	2		1							3		3	3		3
CO6	3	3	3	2							3		3	2		3

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191MEF1	ENGINEERING GRAPHICS	L	T	P	C
		1	0	4	3

Programme: B.E. Electronics and Communication Engineering **Sem: 1 Category: ESC**

Aim: To develop graphic skills in students.

Course Outcomes: The Students will be able to.

CO1: Follow the conventions used in engineering graphics (UN)

CO2: Practice plane curves and free hand sketching (AP)

CO3: Draw the projections of points, lines and plane (AP)

CO4: Draw the projections of simple solids and their sectional views (AP)

CO5: Describe the applications of development of surfaces (AP)

CO6: Practice isometric and perspective projections (AP)

Concepts and conventions (Not for Examination) (1)

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

PLANE CURVES 11

Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – Construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

PROJECTION OF POINTS, LINES AND PLANE SURFACES 12

Projection of Points in all four quadrants - Projection of straight lines located in the first quadrant – inclined to both planes – Determination of true lengths and true inclinations – Projection of regular polygonal and circular lamina inclined to both reference planes.

PROJECTION OF SOLIDS 12

Projection of simple solids like Prisms, Pyramids, Cylinder and Cone when the axis is inclined to one reference plane.

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12

Sectioning of above solids in simple vertical position by cutting planes inclined to HP and perpendicular to VP – Obtaining true shape of section; Development of lateral surfaces of truncated solids – Prisms, Pyramids, Cylinder and Cone

ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS 12

Principles of isometric projection – isometric scale – isometric projections of truncated Prisms, Pyramids, Cylinder and Cone; Conversion of Isometric Views to Orthographic Views and Vice-versa.

Total Periods: 60

Text Books:

1. Natrajan K.V., **"A text book of Engineering Graphics",** Dhanalakshmi Publishers, Chennai (2015)
2. Basant Agarwal and Agarwal C.M., **"Engineering Drawing",** Tata McGraw Hill Publishing Company Limited, New Delhi, (2016)

References:

1. Venugopal K. and Prabhu Raja V., **"Engineering Graphics",** New Age International (P)

Limited (2016)
2. Shah M.B. and Rana B.C., **"Engineering Drawing",** Pearson Education (2009)
3. John K.C., **"Engineering Graphics for degree"** PHI Learning Pvt. Ltd., New Delhi, (2015)
4. Kumar M.S., **"Engineering Graphics",** D.D. Publications, (2015)

Course Outcomes	ProgramOutcomes(POs)												ProgramSpecific Outcomes(PSOs)			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3		3		2					3						
CO2	3		2		2					3						
CO3	3		2		2					3						
CO4	3		3		2					3						
CO5	3		3		2					3						
CO6	2		2		2					3						

Enter correlation levels1,2 or 3 as defined below:1:Slight (Low) 2:Moderate (Medium) 3:Substantial (High)

191HS17	PHYSICS AND CHEMISTRY LABORATORY-I	L-T-P	C
		0-0-2	1

Programme: **B.E./B.Tech.** **Sem: 1** **Category: BSC**
(Common to all Branches)

AIM: To introduce the basic Physics concepts through experiments and to impart the basic analysis in chemistry.

Course Outcomes:

The Students will be able to

CO1: Understand the laser light propagation in optical fibre and the rigidity modulus of the Materials (UN)
CO2: Understand the velocity of sound in liquid and propagation light in the medium (UN)
CO3: Know about the stress analysis and thermal conductivity of the material (UN)
CO4: Gain knowledge of water quality parameter of potable water (UN)
CO5: Determine the unknown concentrations of chemicals (AP)
CO6: Apply the instrumental technique for calculating the amount of unknown substance (AP)

LIST OF EXPERIMENTS - PHYSICS PART
(A minimum of five experiments shall be offered)

S.No	NAME OF THE EXPERIMENT	
1)	(a) Determination of Particle Size using Diode LASER. (b) Determination of wavelength of the LASER source. (c) Determination of Acceptance angle and Numerical aperture ofan optical fibre.	5
2)	Torsional pendulum – Determination of rigidity modulus	4
3)	Determination of Velocity of sound and compressibility of liquid - Ultrasonic Interferometer.	4
4)	Determination of Dispersive power of a prism using Spectrometer.	4
5)	Determination of Young's modulus of the material - Non uniform bending	4
6)	Determination of thermal conductivity of a bad conductor - Lee's Disc method	4

LIST OF EXPERIMENTS – CHEMISTRY PART

S.No	**NAME OF THE EXPERIMENT**	
1)	Estimation of Total Hardness of their home town Water by EDTA method.	4
2)	Estimation of Alkalinity of Water sample	4
3)	Estimation of Chloride ion in water sample by Argentometric method.	4
4)	Estimation of Ferrous Ion by Potentiometric Titrations.	4
5)	Conductometric Titration of strong acid Vs strong base	4

References

1) Text book of Quantitative Inorganic Analysis, A.I.Vogel, ELBS,London,(2006)
2) "Practical A. Ravikrishnan Engineering Chemistry", Sri Krishna Publications, Chennai (2002)
3) Engineering Physics Laboratory Manual
4) Engineering Chemistry Laboratory Manual

Course Outcomes	ProgramOutcomes (Pos)												Program Specific Outcomes (PSOs)			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	1		2		1					1				
CO2	1	2	2				1					1				
CO3	2	2	2				1					1				
CO4	2	2	1		1		2					1				
CO5	3	2	1	2	2		1					2				
CO6	2	1	3		2		2					2				

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191EEF7 BASIC ELECTRICAL AND ELECTRONICS LABORATORY L-T-P C
0-0-2 1

Programme B.E. Electronics and Communication Engineering **Sem: 1 Category: ESC**

AIM: To expose the students to basic laws, characteristics of diodes, operation of D.C and A.C machines and give them experimental skill.

Course Outcomes:

The Students will be able to

CO1. Demonstrate the operation of fluorescent lamp, staircase wiring and simple wiring (UN)

CO2: Apply the circuit theory concepts and analyze the outcome. (AP)

CO3: Interpret the VI characteristics of PN diode (UN)

CO4: Outline the V-I characteristics of a Zener diode (UN)

CO5: Infer the characteristics of DC Machines. (UN)

CO6: Model and analyze the performance characteristics of induction motors. (AP)

LIST OF EXPERIMENTS

1. Simple wiring connection
2. Staircase wiring
3. Fluorescent lamp wiring
4. Study of electronic components and equipments
5. Verifications of ohm's law and kirchoff's voltage law
6. Characteristics of semiconductor diode
7. Characteristics of zener diode
8. Speed control of dc shunt motor
9. Load test on dc shunt motor
10. Load test on single phase induction motor

Total Periods 45

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	1				3		3		3	2	2	2
CO2	3	2		2	1				3		2		3	2		2
CO3	3	2		2	1				3		2		3	2		3
CO4	3	3	2	2	1				3		2		3	2		3
CO5	3	2		2	1				3		3		3	2	1	2
CO6	3	2		2	1				3		3		3	2	1	2

Enter correlation levels1,2 or 3 as defined below:1:Slight(Low) 2:Moderate(Medium) 3:Substantial(High)

191HS21	TECHNICAL ENGLISH	L-T-P	C
		2-0-0	2

Programme: **B.E./B.Tech. (Common to all Branches)** **Sem:** **2** **Category:** **HSMC**

Aim: To develop the students' intellectual, personal & Professional abilities.

Course Outcomes:

The Students will be able to

CO1: Remember words and its meanings for the specific purpose (RM)
CO2: Understand the basic nuances of language (UN)
CO3: Apply written communication methodologies at workplace (AP)
CO4: Develop Listening skill to respond and to gather information (AP)
CO5: Interpret the text using comprehending skill (UN)
CO6: Involve in professional correspondences confidently (UN)

INTRODUCTION TO TECHNICAL ENGLISH **9**

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises. **Speaking** – Asking for and giving directions. **Reading** – reading short technical texts, Newspapers. **Writing** - Purpose statements, Extended definitions, Writing Instructions & Recommendations, Checklists. **Vocabulary Development** - Technical Vocabulary. **Language Development** – Subject Verb Agreement.

READING AND STUDY SKILLS **9**

Listening - Listening to longer technical talks and completing exercises based on them. **Speaking** – Describing a process. **Reading** – Reading longer technical texts, News papers identifying various transitions in a text- paragraphing. **Writing** - Techniques for writing Precisely. **Vocabulary Development** -vocabulary used in formal letters/emails and reports. **Language Development** - Personal & Impersonal Passive voice, Numerical adjectives.

TECHNICAL WRITING AND GRAMMAR **9**

Listening - Listening to classroom lectures on Engineering / Technology. **Speaking** – Introduction to Technical presentations. **Reading** – Reading longer texts both general and Technical, practice in rapid reading. **Writing-** Describing a process, Use of sequence words, Causes and Effects **Vocabulary Development** - Sequence words, Nominal compounds, Misspelled words. **Language Development** - Embedded sentences.

REPORT WRITING **9**

Listening- Listening to documentaries and Making notes. **Speaking** – Mechanics of presentations. **Reading** – Reading for detailed comprehension. **Writing -** Job application, cover letter, Resume preparation. **Vocabulary Development** - Finding suitable synonyms, Paraphrasing. **Language Development** – Clauses, If conditionals.

GROUP DISCUSSION AND JOB APPLICATIONS **9**

Listening - TED/Ink talks. **Speaking** – Participating in a Group discussion. **Reading** – Reading and Understanding Technical articles. **Writing** – Writing reports, Minutes of Meeting, Introduction and Conclusion. **Vocabulary Development -** Verbal analogies**. Language Development -** Reported speech.

Total Periods: 45

Text books:

1. Sudharshana,N.P. and C.Savitha. English for Technical Communication. New Delhi: Oxford University Press, 2017.

References:

1. www.bbc.co.uk/learning english
2. www.bec cambridge english.org
3. www.englishenglish101.com
4. www.islcollective.com

Extensive Reading

1. Kalam, Abdul. The Wings of Fire. Hyderabad: UP, 1999. Print.

Course Outcomes	Programmme Outcomes(POs)												ProgramSpecific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1																
CO2															2	
CO3								1		2			3			
CO4																
CO5																
CO6											2			1		

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191HS22 DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS L-T-P C
3-1-0 4

Programme: **B.E./B.Tech. (Common to all branches)** **Sem: 2** **Category: BSC**

Aim: To analyze the engineering problems using the techniques and the mathematical skills acquired by studying ODE and PDE uses numerical methods.

Course Outcomes:

The students will be able to

CO1: Use suitable method to solve higher order Differential Equations (AP)

CO2: Use suitable method to solve higher order PDE (AP)

CO3: Interpolate discrete data by means of continuous function (AP)

CO4: Discover Numerical integration using Trapezoidal and Simpson's $1/3^{rd}$ rules (AP)

CO5: Find the solution for the IVPs in ODE using single step and Multistep methods (AP)

CO6: Find the solution of BVPs in PDE using finite difference methods (AP)

ORDINARY DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations–Lagrange's linear equation–Solutions of standard types of first order partial differential equations (without reducing the standard type) –Linear homogenous partial differential equations of second and higher order with constant coefficients.

SOLUTION OF EQUATION & INTERPOLATION, NUMERICAL DIFFERENTIATION 12

Solutions of Polynomial and transcendental equations – Newton Raphson method - Interpolation using Newton's forward and backward difference formulae - Interpolation with unequal intervals- Newton's divided difference and Lagrange's formulae - Numerical differentiation using Newton's forward and backward difference formula - Numerical Integration – Trapezoidal rule and Simpson's $1/3^{rd}$ rule..

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method – Milne's predictor – corrector methods for solving first order equations – Finite difference methods for solving second order equation.

BOUNDARY VALUE PROBLEMS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Finite differences solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

Total Periods: 60

Text books:

1. B.S. Grewal, 'Higher Engineering Mathematics', Thirty Sixth Edition, Khanna Publishers, Delhi,2005
2. Grewal B.S. and Grewal J. S., "Numerical Methods in Engineering and Science", Khanna Publishers New Delhi, (2004).

References:

1. Greenberg. M.D. "Advanced Engineering Mathematics, Second Edition, Pearson Education Inc.(First Indian reprint), 2002
2. Venkataraman. M.K., "Engineering Mathematics", Volume I and II Revised enlarged 4^{th} Edition, The National Publishing Company, Chennai, 2004.
3. Kreyszig, E., Advanced Engineering Mathematics, 8th edition, John Wiley Sons, 2001.

4. Chapra S.C. and Canale R.P, "Numerical Methods for Engineers", Tata Mc-Graw Hill,New Delhi, (2007).
5. Gerald C.F, and Wheatley P.O, "Applied Numerical Analysis", Pearson Education Asia,NewDelhi,(2006).

Course Outcomes	ProgramOutcomes(POs)												ProgramSpecific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1		1								3		2	1	
CO2	2	2		2												1
CO3	2	1		2								1	2			
CO4	1	2		3								2			2	
CO5	2	3												2		
CO6	3	3			3				1			2	2			2

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191HS23 PHYSICS OF MATERIALS L-T-P C
2-0-0 2

Programme: **B.E., (CSE, EEE,ECE & Bio Medical)** **Sem: 2** **Category: BSC**

AIM: To endow the students with the fundamentals of physics, materials and apply new ideas in the field of Engineering and Technology.

Course Outcomes:

The Students will be able to

CO1: Understand the theory and processing of conducting, superconducting materials (UN)
CO2: Acquire knowledge of classification of semi conducting materials (UN)
CO3: Gain knowledge about the types of magnetic materials and their applications (UN)
CO4: Enhance the knowledge about dielectric materials and their applications (UN)
CO5: Understanding on the functioning of optical materials for optoelectronics (UN)
CO6: Know about the basics of quantum structures and their applications in spintronics (UN)

ELECTRICAL PROPERTIES OF MATERIALS **9**

Conductors: classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory –Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

Super Conductors: properties - Types of super conductors - Applications of superconductors – SQUID, cryotron, magnetic levitation.

SEMICONDUCTOR PHYSICS **9**

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – Extrinsic semiconductors – carrier concentration derivation in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration– Hall effect –Determination of Hall coefficient – Applications.

MAGNETIC AND DIELECTRIC MATERIALS **9**

Magnetic Materials: Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications.

Dielectric Materials: Polarization - electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation –dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

OPTICAL PROPERTIES OF MATERIALS **9**

Classification of optical materials–carrier generation and recombination processes-Absorption - emission and scattering of light in metals, insulators and Semiconductors (concepts only)-photocurrent in a P-N diode–solar cell–photo detectors-LED-optical storage techniques

NEW MATERIALS **9**

Metallic glasses: Preparation, properties and applications.

Shape memory alloys (SMA): Characteristics - Properties of NiTi alloy – Applications - Advantages and disadvantages of SMA.

Nanomaterials: synthesis – chemical vapour deposition– ball milling - properties of nanoparticles and applications

Bio Materials : Classification – Properties – Applications

Total Periods: 45

Text books:

1. William D. Callister, Jr., **"Material Science and Engineering",** John Wiley & Sons Inc., Seventh Edition, New Delhi (2017).
2. Kasap, S.O. **"Principles of Electronic Materials and Devices**", McGraw -Hill Education, 2016.

References:

1. Koch C., **"Nanostructured materials: processing, properties and applications",** William Andrew pub. (2011).
2. Charles P. Poole and Frank J.Ownen., **"Introduction to Nanotechnology"**, Wiley India (2016)
3. Charles Kittel., **"Introduction to solid state Physics"**, John Wiley & Sons, 7th editions, Singapore (2012)
4. Ragavan, V., **"Material science and Engineering"**, Prentice Hall of India (2004).
5. Umesh K Mishra & Jasprit Singh, "**Semiconductor Device Physics and Design**", Springer, 2014.

Course Outcomes	ProgramOutcomes(POs)												ProgramSpecific Outcomes(PSOs)			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	1	1			3			1			1	3	1		
CO2	3	2	2	1		1						1	2	1	1	
CO3	1		2	1		2	1		1				1	2		
CO4	2	2	1	1		2		1					2	2		
CO5	3	1	3	2	2								2	1	1	
CO6	3	3	3	2	3	2	1						3		1	1

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191HS24	ENVIRONMENTAL SCIENCE	L-T-P	C
		2-0-0	2

Programme: B.E./B.Tech. (Common to all branches) **Sem:** 2 **Category:** BSC

Aim: To Impart the social groups and individuals to acquire knowledge of pollution and environmental degradation

Course Outcomes: The student will be able to

CO1: Understand the basic concepts of environment and energy resources (UN)
CO2: Get knowledge about the ecosystem (UN)
CO3: Identify and analyze causes, effects and control measures of various types of pollution (AP)
CO4: Get the knowledge about types of disaster and mitigation measures (UN)
CO5: Understand the impact of social issues and climate change (UN)
CO6: Understand to create the green environment (UN)

ENVIRONMENT AND ENERGY RESOURCES **9**

Environment- definition, scope and importance – Need for public awareness – Forest resources-deforestation–Energy resources: Growing energy needs, renewable (solar energy and wind energy) and non renewable energy sources-Nuclear energy – fission and fusion reactions and light water nuclear reactor for power generation (block diagram only), Petroleum processing and fractions

ECOSYSTEM **9**

Concept of an ecosystem – Structure and function of an ecosystem: Producers, consumers and decomposers, Energy flow in the ecosystem-Nitrogen cycle,Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the Forest ecosystem and Aquatic ecosystems (lake and rivers)

ENVIRONMENTAL POLLUTION **9**

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Marine pollution (d) Noise pollution . Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution –Disaster management: floods- landslides.

SOCIAL ISSUES AND EARTH'S CLIMATE SYSTEM **9**

Population-variation among nation-Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting– climate change, global warming, acid rain, Ozone layer depletion.

GREEN CHEMISTRY **9**

Introduction to green chemistry- 12 principles of green chemistry-toxicology and green chemistry-energy and green chemistry-education in green chemistry. Reuse and recycling technologies-material selection for green design-recycled water technology.

Total Periods: 45

Text books:

1. A. Ravikrishnan, "Environmental Science and Engineering, Sri Krishna Hitech Publishing Company Private Limited, 2010.
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.

References:

1. Anubha Kaushik, C.P. Kaushik, "Environmental Science and Engineering", New Age International Publishers, 2016.

2. Benny Joseph, Environmental Science and Engineering, Tata McGraw-Hill Publishing Company Ltd, New Delhi, ISBN: 0070601690, 2006.
3. Raman Sivakumar, Introduction to Environmental Science and Engineering, Tata McGraw Hill Education Private Limited, New Del2010.
4. P.Meenakshi, Elements of Environmental Science and Engineering, PHI learning (P) Ltd., India.

Course Outcomes	ProgramOutcomes (POs)												ProgramSpecific Outcomes(PSOs)			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	2		1	1	1	1				2	3	2	1		1
CO2	2	2	1		1	2	1				1	2		1		2
CO3	2	1	1	2	2			1				2		1		
CO4	2	2	1		1						2	2			2	
CO5	2	2	1		1	1						2				2
CO6	2	2	1		2	1			1	1	1	2			2	

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191CSF1	PROGRAMMING FOR PROBLEM SOLVING	L-T-P	C
		3-0-0	3

Programme: B.E., (ECE,CSE,BME) **Sem:** 2 **Category:** ESC

Aim: To provide an awareness to Computing and Programming.

Course Outcomes:

The students will be able to

CO1: Understand the basic terminologies of Computer and various Problem solving techniques (UN)

CO2: Write, compile and debug programs in C language (AP)

CO3: Use different data types in a computer program (AP)

CO4: Design programs involving decision structures, loops and functions (AP)

CO5: Understand the dynamics of memory by the use of pointers (UN)

CO6: Use different data structures and create/update basic data files (AP)

INTRODUCTION **9**

Generation and Classification of Computers- Basic Organization of a Computer - Number System - Binary - Decimal - Conversion - Problems. Software - Types, Development Steps. Algorithm - Pseudo code - Flow Chart. Problem formulation - Problem Solving.

C PROGRAMMING BASICS **9**

Introduction to Unix Operating System - Introduction to ' C' programming - fundamentals - structure of a 'C' program - compilation and linking processes - Constants, Variables - Data Types - Expressions using operators in 'C' - Managing Input and Output operations - Decision Making and Branching - Looping statements - solving simple scientific and statistical problems.

ARRAYS AND STRINGS **9**

Arrays - Initialization - Declaration - One dimensional and Two dimensional arrays. String- String operations - String Arrays. Simple programs –Bubble Sort – Linear Search -Matrix Operations.

FUNCTIONS AND POINTERS **9**

Function - Definition of function - Declaration of function - Pass by value - Pass by reference - Recursion - Pointers - Definition - Initialization - Pointers arithmetic - Pointers and arrays- Example Problems.

STRUCTURES AND FILES **9**

Introduction - need for structure data type - structure definition - Structure declaration - Structure within a structure - Union - Programs using structures and Unions - File Manipulation - Storage classes - Pre-processor directives.

Total Periods 45

Text books:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2017.
2. Balagurusamy E, "Programming in ANSI C", Tata Mcgraw-Hill Education, 2016

References:

1. Byron S Gottfried, "Programming with C", Schaum's Outlines, 3rdEdition, McGraw-Hill, 2017.
2. Dromey R.G., "How to Solve it by Computer", Pearson Education, 4th Reprint, 2007.
3. Kernighan.B.W and Ritchie,D.M, "The C Programming language", 2nd Edition, Pearson Education, 2006.

4. Reema Thareja, “Computer Fundamentals and Programming in C”, 2e, Oxford University Press, 2016.

Course Outcomes	ProgramOutcomes(POs)												ProgramSpecific Outcomes(PSOs)			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2						3	2		3	2		2	2
CO2	3	3	3						2	1		3	2		2	2
CO3		3	2						2			2				
CO4		3	3						3			3	2		2	1
CO5	2	3	2									2	1		1	1
CO6		2	3						2			3			1	1
CO7	2	2	2	2	2							2	2		2	3

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191MEF7	MECHANICAL WORKSHOP	L-T-P	C
		1-0-4	3

Programme: **B.E., (ECE,CSE,BME)** **Sem:** **2** **Category:** **ESC**

Aim: To Provide exposure to the students with hands on experience on various basic Engineering Practices

Course Outcomes:

The students will be able to

CO1: Make the square fitting, vee & step fitting (AP)

CO2: Produce simple wooden joints using wood working tools (AP)

CO3: Fabricate tray and funnel in sheet metal (AP)

CO4: Create simple lap, butt and tee joints using arc welding equipments (AP)

CO5: Identify the various pipe joints (AP)

CO6: Make the pipe connections (AP)

FITTING OPERATIONS & POWER TOOLS **12**

Preparation of square fitting, vee & step – fitting models

CARPENTRY **12**

Study of the joints in roofs, doors, windows and furniture; Hands-on-exercise: Dismantling & Assembling of various wooden furniture; Preparation of T Joint, dove tail joint

SHEET METAL FORMING **12**

Preparation of tray and funnel

WELDING **12**

Preparation of arc welding of butt joints and lap joints

PLUMBING **12**

Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings; Hands-on-exercise - basic pipe connections – Mixed pipe material connection – Connections with different joining components

Total Periods: 60

LIST OF EQUIPMENTS (For a batch of 30 students)

1. Fitting vice (fitted to work bench) - 15Nos
2. Fitting Tools – 15 set
3. Carpentry vice (fitted to work bench) - 15 Nos.
4. Models of industrial trusses, door joints, furniture joints - 5 Nos.
5. Standard woodworking tools - 15 Sets
6. Hand Shear - 01
7. Standard tools and calipers for sheet metal work - 05
8. Arc welding transformer with cables and holders - 5Nos.
9. Welding booth - 5 Nos.
10. Welding accessories like welding shield, chipping hammer, Wire brush, etc., - 5Sets
11. Assorted components for plumbing consisting of metallic pipes, Plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings - 15 Sets.

Course Outcomes	ProgramOutcomes(POs)												ProgramSpecific Outcomes(PSOs)			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2		3		1				3			3	2	3		2
CO2	2		3		1				3			3	2	3		2
CO3	2		3		1				3			3	2	3		2
CO4	2		3		1				1			3	2	3		2
CO5	2		3		1				1			3	2	3		2
CO6	2		3		1				3			3	2	3		2

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191HS27 PHYSICS AND CHEMISTRY LABORATORY-II L-T-P C
0-0-2 1

Programme: B.E/B.Tech (Common to all Branches) **Sem: 2 Category: BSC**

AIM: To introduce the basic Physics concepts through experiments and to impart knowledge on the application of chemistry in engineering branches.

Course Outcomes:

The Students will be able to

CO1: Learn the interference of light and young's modulus of the materials (UN)
CO2: Understand the properties of flow of the liquid (UN)
CO3: Know the band gap of material and resistance of the given coil (UN)
CO4: Determine the quantity of unknown solution by instrumental technique (AP)
CO5: Determine the concentration of an identified analyte by volumetric analysis (AP)
CO6: Analyze the characteristics of water (AN)

LIST OF EXPERIMENTS - PHYSICS PART (A minimum of five experiments shall be offered)		
S.No	**NAME OF THE EXPERIMENT**	
1)	Determination of thickness of thin wire – Air wedge method	5
2)	Determination of Young's modulus of the material – Uniform bending	4
3)	Determination of viscosity of liquid – Poiseuille's method.	4
4)	Determination of wavelength of mercury spectrum- Spectrometer Grating.	4
5)	Determination of Band Gap of a semiconductor material.	4
6)	Determination of specific resistance of a given coil of wire – Carey Foster Bridge.	4

LIST OF EXPERIMENTS – CHEMISTRY PART		
S.No	**NAME OF THE EXPERIMENT**	
1)	Estimation of HCl by pH metry	4
2)	Estimation of Copper in brass by EDTA method.	4
3)	Estimation of iodine in iodized salt with thiosulfate	4
4)	Determination of percentage of calcium in limestone by EDTA method	4
5)	Determination of DO in water (Winkler's method)	4

References

1) Text book of Quantitative Inorganic Analysis, A.I.Vogel, ELBS,London, (2006).
2) "Practical A. RaviKrishnan Engineering Chemistry", Sri Krishna Publications, Chennai (2002)
3) Engineering Physics Laboratory Manual
4) Engineering Chemistry Laboratory Manual

Total Periods:45

Course Outcomes	Program Outcomes(POs)												ProgramSpecific Outcomes (PSOs)			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	1	1		1		3			1	2	2		2
CO2	3	3	2	1	1		1		3			1	2	2		2
CO3	3	2	2	1	1		1		3			1	2	2		2
CO4	3	3	2	2	2		1		3			1	2	2		2
CO5	3	2	2	2	2		2		3			2	2	2		2
CO6	3	2	2	2	2		2		3			2	2	2		2

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191CSF7 C PROGRAMMING LABORATORY L-T-P C
0-0-2 1

Programme: B.E.,**(ECE,CSE,BME)** **Sem: 2 Category: ESC**

AIM: To provide practical knowledge in developing C Programming.

Course Outcomes:

The Students will be able to

CO1: Able to have fundamental concept on basics commands in Linux (UN)
CO2: Able to write, compile and debug programs in C language (UN)
CO3: Able to formulate problems and implement algorithms in C (AP)
CO4: Able to effectively choose programming components that efficiently solve computing problems in real-world (UN)
CO5: Able to design application oriented programs in C (AP)
CO6: Structures and unions through which derived data types can be formed (AP)

LIST OF EXPERIMENTS:

1. Draw a flowchart for various algorithms using Raptor
2. C Programming using Simple statements and expressions.
3. Scientific problem solving using decision making and looping.
4. Simple programming for one dimensional and two dimensional arrays.
5. Solving problems using String functions.
6. Programs with user defined functions - Includes Parameter Passing.
7. Program using Recursive Function and conversion from given program to flow chart.
8. Programs using pointers
9. Program using structures and unions.
10. Program using files.

Total Periods 60

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C compiler 30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

Course Outcomes	ProgramOutcomes(POs)												ProgramSpecific Outcomes(PSOs)			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	1	2						2							
CO2	3	2	2						2				2		2	2
CO3	3	2	3						2				2		2	2
CO4	2	3	2						2				1		2	2
CO5	3		2						2						1	1
CO6	2		2										1			2

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191HS31	TRANSFORMS AND DISCRETE MATHEMATICS	L-T-P	C
		2-2-0	3

Programme: **B.E./B.Tech. (Common to all branches)** **Sem:** 3 **Category:** BSC

Aim: To introduce basic mathematical ideas such as reasoning techniques, basic counting techniques and their applications .

Course Outcomes:

The students will be able to

CO1: Apply Laplace transform to solve first and second order differential equations with elementary Function (AP)

CO2: Explain the Fourier transform and with their properties (UN)

CO3: Determine Z-inverse transform using convolution theorem and partial fraction method (AP)

CO4: Apply mathematical induction and prove a relation (AP)

CO5: Invent Eulerian and Hamiltonian paths to find shortest paths (AP)

CO6: Make use of graph theoretic models to solve basic problems in networks (AP)

LAPLACE TRANSFORMS **9**

Laplace transform —Properties of Laplace Transforms – Laplace Transform of periodic functions – Inverse Laplace transforms by partial fraction method and Convolution theorem (excluding proof) – Solving ODE using Laplace transformation techniques.

FOURIER TRANSFORMS **9**

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms– Properties–Transforms of simple functions–Convolution theorem –Parseval's identity.

Z-TRANSFORMS **9**

Z-transforms–Elementaryproperties–InverseZ-transform–Convolutiontheorem– Formation of Difference equations–Solution of difference equations using Z-transform.

INTRODUCTION TO COUNTING **9**

Decision problems on Propositional logic – Basic counting techniques – inclusion & exclusion-Pigeonhole principle –Permutations and combinations-Recurrence relations-Solving Linear recurrence relations and generating functions

INTRODUCTION TO GRAPHS **9**

Graphs and their basic properties– Graph terminology and special types of graphs - Representing graphs and graph isomorphism – Euler and Hamilton paths.

Total Periods: 45

Text Book

1. B.S.Grewal, 'Higher Engineering Mathematics', Thirty Sixth Edition, Khanna Publishers, Delhi, 2005.

2. Grewal B.S. and Grewal J. S., "Numerical Methods in Engineering and Science", Khanna Publishers, New Delhi, (2004).

Reference

1. Greenberg. M.D. "Advanced Engineering Mathematics, Second Edition, Pearson Education Inc. (First Indian reprint), 2002
2. Venkataraman.M.K., "Engineering Mathematics", Volume I and II Revised enlarged Fourth Edition, The National Publishing Company, Chennai, 2004.
3. Trembly J. P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, NewDelhi, 30th Re-print (2007).

4. Dr.P.Kandasamy,Dr.K.Thilagavathy,Dr.K.Gunavathy,"Transforms and Partial Differential Equation", S.Chand& Company Ltd. Ram Nagar,New Delhi.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1			1							3			
CO2	2	2				2				2				1		
CO3	3			1	1					1						2
CO4	1										2		1			
CO5	2	2					1								2	
CO6	3	2					2			1						2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191BS31 **BIOLOGY FOR ENGINEERS** **L T P C**
3 0 0 3

Programme: B.E./ B.Tech. (Common to all Branches). **Sem: 3 Category: BSC**

Aim: To understand basic and fundamental engineering knowledge from biology.

Course Outcomes: The Students will be able to.

CO1: Recall the various biochemical interactions and the structure and function of various biological molecules.(UN)

CO2: Explain basic concepts of thermodynamics and energy transactions.(UN)

CO3: Discuss different aspects of molecular computing.(UN)

CO4: Identify the Mendelian laws of inheritance.(AP)

CO5: Describe cellular architecture and utilize these concepts to design an engineering system.(UN)

CO6: Apply fundamental concepts in sensor physiology analogy with communication systems.(AP)

INTRODUCTION **9**

Biological analogy in engineering science, Biological elements-Carbohydrate, protein, amino acids, lipids and nucleic acids structure and function. Primary, secondary, tertiary and quaternary structure of protein. Protein as enzymes, transporter, receptors and structural elements.

METABOLISM AND ENGINEERING **9**

Engineering aspects in thermodynamics of energy transactions, exothermic and endothermic versus endergonic and exergonic reactions. ATP as an energy source, glycolysis, Krebs cycle and photosynthesis. Energy yielding and energy consuming reactions. Enzymes classification, mechanism of enzyme action, enzyme kinetics and kinetic parameters.

GENETICS AND TRANSFORMATION TECHNOLOGY **9**

Molecular basis of information transfer. DNA as a genetic material. Concept of genetic code. Mendal's laws, concept of segregation and independent assortment. Concept of allele, Gene mapping, Gene interaction, Epistasis, concepts of recessiveness and dominance and their relativeness to programming. Cell multiplication. Phenotype and genotype. Single gene disorders in humans and human genetics.

CLASSIFICATION AND SYSTEM ENGINEERING **9**

Structure, function and relativeness to engineering of prokaryotes and eukaryotes. Habitats- aquatic or terrestrial. Molecular taxonomy-three major kingdoms. Microbial species and strains. Identification and classification of microorganisms. Industrial application of microorganisms. Sterilization and media compositions. Growth kinetics.

SENSOR BIOLOGY AND COMMUNICATION SYSTEMS **9**

Sensory system, circulatory system and excretory system and their relativeness to communication engineering. Hormonal regulation. General defense mechanism in human. Major human disorder and diseases.

Total Periods: 45

Text Books:

1. Arthur T. Johnson, "Biology for Engineers", CRC Press, New York 2011.
2. ThyagaRajan. S., Selvamurugan. N., Rajesh.M.P., Nazeer. R.A., Richard W. Thilagaraj, Barathi. S., Jaganthan. M.K., "*Biology for Engineers"*, Tata McGraw-Hill, New Delhi, 2012.

References:

1. Rajiv Singal, Gaurav Agarwal, RituBir, Biology for Engineers, CBS Publisher, 2019.
2. Charles Molnar and Jane Gair, Concepts of Biology-1st Canadian Edition, Open Stax Publication, 2013.
3. Raven Johnson, Biology, 11th edition, Mc Graw Hill Publication, 2017.

Course Outcomes	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3										3				
CO2	3	3						3				2				
CO3	3		2									1				
CO4	3			2								1				
CO5	3							3				2		2		
CO6	3	3	2			3						1	2	2		

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC31 CIRCUITS AND ELECTRONIC DEVICES L-T-P C
3-1-0 4

Programme: B.E. - Electronics and Communication Engineering **Sem: 3 Category: PC**

Aim: To enable the students to develop skills in identifying and testing of electronic components and designing circuits using BJT and FET.

Course Outcomes: The students will be able to

CO1: Apply basic electrical laws and also analyze mesh and nodal analysis for DC and AC circuits. (AP)
CO2: Analyze various network reduction and network theorems for DC and AC circuits.(AN)
CO3: Explain the transient responses of RL, RC and RLC circuits.(UN)
CO4: Demonstrate the construction and operation of Transistors. (UN)
CO5: Illustrate the characteristics of FETs.(UN)
CO6: Interpret the characteristics of special diodes and devices.(UN)

BASIC LAWS AND NETWORKS THEOREMS 12

Review of Kirchoff's laws, series and parallel connection of independent sources, R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

TRANSIENT RESONANCE IN RLC CIRCUITS 12

RL, RC and RLC circuits and their responses to pulse and sinusoidal inputs – frequency response – Parallel and series resonances – Q factor – single tuned circuits.

BIPOLAR JUNCTION TRANSISTORS 12

Need for biasing-biasing methods - Fixed bias-Self bias- Bias Stability - Stability factor-Bias Compensation methods -NPN and PNP Transistor – Configuration-I/O Characteristics of CE,CB and CC Configurations -h-Parameters for CE configuration - Comparison of CE,CB and CC configurations.

FIELD EFFECT TRANSISTORS 12

Biasing of FET and MOSFET - Construction and Operations of JFET -Drain and Transfer Characteristics-Parameters of JFET-Saturation Drain Current-Slope of the Transfer Characteristics at IDSS- Comparison of JFET and BJT-Construction and Operation of MOSFET-Depletion Type and Enhancement Type -Comparison of MOSFET with JFET-Charge Coupled Devices(CCD).

SPECIAL SEMICONDUCTOR DEVICES 12

Tunnel diodes – PIN diode, varactor diode, Schottky diode – SCR characteristics and two transistor equivalent model – UJT – DIAC and TRIAC – Laser, Photodiode, Phototransistor, LED, LASERs, MISFETs,MESFETs, TFETs, HEMTs.

TOTAL PERIODS 60

Text Book:

1. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Shaum series,Tata Mc Graw Hill, 2007

References:

1. Nandhitha Das Gupta and Amitava Das Gupta "Semiconductor Devices: Modeling and Technology" Prentice Hall of India Pvt Ltd, 4th edition, 2004.
2. Adel S. Sedra and Kenneth C.Smith, "Microelectronic Circuits", Oxford University Press, 6th

edition, 2009.
3. Simon M.Sze and Kwok K.Ng, "Physics of Semiconductor Devices", John wiley& sons, 3rdedition, 2006.
4. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits",Tata McGraw Hill,
2nd edition, (2008).
5. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5thedition,2008.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2	2						2	3	3		2
CO2	3	3	2	2	2							2	2	3		2
CO3	3	3	3	2	2							3	3	3		2
CO4	3	3	2	2	2	2						2	2	3		2
CO5	3	3	2	2	2	2						3	3	3		2
CO6	3	3	2	2	2	2						3	3	3		2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC32	LINEAR INTEGRATED CIRCUITS			L-T-P	C
				3-0-0	3
Programme:	B.E. Electronics and Communication Engineering	**Sem:**	3	**Category:**	PC

AIM: To learn the basic concepts in the design of electronic circuits using linear integrated circuits and their applications in the processing of analog signals.

Course Outcomes: The students will be able to

CO1: Interpret the operational amplifier stages and its AC, DC performance characteristics. (UN)

CO2: Construct the applications of operational amplifier. (AP)

CO3: Illustrate the concepts of analog multiplier IC and PLL IC. (UN)

CO4: Classify the types of digital-to-analog and analog-to-digital converters. (UN)

CO5: Build different types of waveform generators. (AP)

CO6: Explain the astable and monostable operation of timer IC 555. (UN)

CIRCUIT CONFIGURATION FOR LINEAR ICs **9**

Advantages of ICs over discrete components –General operational amplifier stages and internal circuit diagrams of IC 741– DC and AC performance characteristics – Slew rate – Open and Closed loop configurations.

APPLICATIONS OF OPERATIONAL AMPLIFIERS **9**

Scale Changer – Adder and Subtractor – Instrumentation amplifier – Phase Shift Circuits – Voltage Follower – V-to-I and I-to-V converters – Peak detector – Clipper and Clamper – Differentiator – Integrator – Comparators – Schmitt trigger –Low-pass, high-pass and band-pass filters

ANALOG MULTIPLIER ICs AND PLL ICs **9**

Analog Multiplier ICs and its applications — Operation of the basic PLL, Closed loop analysis of PLL, Voltage Controlled Oscillator(VCO), Block diagram of PLL IC 565 and its applications for frequency synthesizing, frequency multiplication and division.

A/D AND D/A CONVERTERS **9**

Analog and Digital Data Conversions, D/A converter – specifications - Weighted resistor type, R-2R Ladder type, Voltage Mode R-2R Ladder and Current-Mode R-2R Ladder types - Sampling Process-High speed sample and hold circuit, A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type - Dual Slope type - A/D Converter using Voltage-to-Time Conversion.

WAVEFORM GENERATORS AND SPECIAL FUNCTION ICs **9**

Sine-wave generators, Multivibrators, Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555-GeneralDescription - Monostable and Astable operation of Timer IC 555 – LM317 adjustable voltage regulators.

Total Periods 45

Text Book

1.RoyChoudhry.D, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd, 4th Edition, 2014.

References

1. Salivahanan.S &KanchanaBhaskaran.V.S., “Linear Integrated Circuits”,3rdEdition, McGraw

Hill, 2018.
2. Sonde.B.S., "System design using Integrated Circuits" , New Age Pub, 2nd Edition, 2001
3. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, 2005.
4. Ramakant.A.Gayakwad, "OP-AMP and Linear Ics", Prentice Hall / PE, 4thedition, 2001.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2								2	2	3		2
CO2	2	2	2									1	2	3	2	2
CO3	3	2	3	2	2	2			1			2	2	3	2	2
CO4	3	2	2		1	1			1			2	2	3		2
CO5	2	2	2	1	1	1			2			2	2	3	2	2
CO6	3	2	2	2	2	1			1			2	2	3	2	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC33 NETWORKS AND TRANSMISSION LINES L-T-P C
3-0-0 3

Programme: B.E. Electronics and Communication Engineering **Sem:**3**Category: PC**
Aim: To study and analyze the Networks and Transmission line parameters.

Course Outcomes:

The student will be able to
CO1: Model the two port networks. (AP)
CO2: Build the lumped filters. (AP)
CO3: Explain the properties of passive network. (UN)
CO4: Develop the different forms of RLC network. (AP)
CO5: Derive the different parameters of transmission line.(UN)
CO6: Make use of the smith chart to compute VSWR and reflection co-efficient. (AP)

SYMMETRICAL AND ASYMMETRICAL TWO PORT NETWORKS 9

Two port networks- Characterization in terms of impedance, Admittance, Hybrid and Transmission parameters - Inter relationships among parameter sets - Interconnection of two port networks - Series, parallel and cascade. Lattice Networks-Symmetrical two port networks: T and π Equivalent of a two port network - Image impedance - Characteristic impedance and propagation constant of a symmetrical two port network.

LUMPED FILTERS 9

The neper - the decibel - Current and voltage ratios - Propagation constant, - Filter fundamentals – Pass and Stop bands. Behaviour of the Characteristic impedance. Constant K Filters - Low pass, High pass band, pass band elimination filters - m - derived sections – Filter circuit design – Filter performance – Crystal Filters. Symmetrical and asymmetrical attenuators - T and π sections.

PASSIVE NETWORK SYNTHESIS 9

Synthesis: Positive real functions - Driving point functions - Brune's positive real functions - Properties of positive real functions. Testing driving point functions - Application of maximum modulus theorem - Properties of Hurwitz polynomials -Even and odd functions - Strum's theorem - Driving point synthesis - RC elementary synthesis operations - LC network synthesis - Properties of RC network functions - Foster and Cauer forms of RC and RL networks.

TRANSMISSION LINE THEORY 9

A Line of cascaded T sections – Transmission lines – General Solutions , Physical Significance of the equations, The infinite line, Wavelength, Velocity of Propagation, Distortionless line, The telephone cable, Reflection on a line not terminated in Z_0, Reflection Coefficient, Open and Short Circuited Lines, Insertion loss.

LINE AT RADIO FREQUENCIES 9

Parameters of open wire line and co-axial line at high frequencies- Standing wave ratio-Input impedance of open and short circuited lines-Relation between VSWR and reflection co-efficient-Quarter wave transformer-Single stub matching-Smith chart and its applications.

Total Periods: 45

Text Book(s)

1. Sudhahar.A, Shyammohan S.P, "Circuits and Networks: Analysis and Synthesis", TataMcGrawHill, New Delhi, 5th edition 2015.
2. John.D.Ryder "Network lines and fields", Prentice Hall of India Pvt. ltd, 4thb Edition 2007.

Reference(s)

1. Umesh Sinha "Network analysis and Synthesis", Sathya Prakashan Publishers, 2010.
2. Van Valkenburg "Introduction to modern Synthesis", Wiley Eastern Publication, 2007.
3. B.P Lathi, "Linear Systems and Signals", Oxford University Press, 2nd Edition, 2009.
4. D. Roy Choudhary, "Network and Systems", New Academic Science, 2nd Edition, 2009.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3								2	3		3	2
CO2	3	3	2	3	3							2	3	2	3	2
CO3	3	3	2	2	2							2	3	2	3	2
CO4	3	3	2	2		1			1			2	3	2	3	2
CO5	2	3	3	2	2							2	3		3	2
CO6	3	3	2	3	2	1						2	3	2	3	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191CS35	DATA STRUCTURES AND C++	L	T	P	C
		3	0	2	4

Programme: B.E. Electronics and Communication Engineering **Sem:3** **Category: ESC**

AIM: To provide an in-depth knowledge in basic concepts of object oriented programming and fundamental concepts of data structures.

Course Outcomes:

The Students will be able to

CO1: Explain the concepts of object oriented programming.(UN)
CO2: Apply proper class protection mechanism to provide security.(AP)
CO3: Apply various object oriented features for various computing problems.(AP)
CO4: Interpret the importance of structure and abstract data type, and their basic usability. (UN)
CO5: Illustrate various data structures for various computing problems.(UN)
CO6: Construct data structures for any application. (AP)

PRINCIPLES OF OBJECT ORIENTED PROGRAMMING 9

Introduction – Beginning with C++, Tokens, Expressions, Control Structures, Functions in C++, Classes and objects, Operators overloading and type conversions.

BASIC CONCEPTS OF OBJECT ORIENTED PROGRAMMING 9

Inheritance, Constructors and destructors, Pointers, Virtual functions and polymorphism, Exception handling.

LINEAR DATA STRUCTURES 9

Arrays and its representations – Stacks and Queues – Linked lists – Linked list-based implementation of Stacks and Queues – Evaluation of Expressions.

NON LINEAR DATA STRUCTURES 9

Trees – Binary trees – Binary tree representation and traversals –Binary Search Trees, Graph Algorithms – Representation – Shortest path algorithms: Dijkstra's algorithm – Minimum spanning tree.

SORTING 9

Sorting – Preliminaries – Bubble Sort, Insertion sort, Shell sort, Merge sort, Quick sort, Bucket sort.

LAB COMPONENT

LIST OF EXPERIMENTS:

1. Basic Programs for OOPS concepts.
2. Array implementation of stacks and queues.
3. Linked list implementation of stacks and queues.
4. Application of Stacks and Queues.
5. Implementation of Binary SearchTree.
6. Implementation of Sorting.

Text books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3rd edition, Pearson EducationAsia, 2014.
2. E. Balagurusamy, "Object Oriented Programming with C++", 4th edition, McGraw Hill Company Ltd., 2009

References:

1. Michael T. Goodrich, "Data Structures and Algorithm Analysis in C++", Wiley student edition, 2007.

2. Seymour, "Data Structures", The McGraw-Hill, 2007.
3. Jean – Paul Tremblay & Paul G.Sorenson, An Introduction to data structures with applications, Tata McGraw Hill edition, 2nd Edition, 2007.
4. John R.Hubbard, Schaum's outline of theory and problem of data structure with C++, McGraw-Hill, New Delhi, 2004.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3		2				3	1	1	2	2		2	3
CO2	3	2	2	2	2				3	1	1	2	2		2	3
CO3	2	2	2	2	2	1			3	1		2	2		2	3
CO4	3	2	2		2				3	1	1	2	2		2	3
CO5	3	2	2	2	2	2			3	1		2	2		2	3
CO6	2	2	2	2	2	2			3	1	2	2	2		2	3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC37 CIRCUITS AND DEVICES LABORATORY L-T-P C
0-0-2 1

Programme: B.E. - Electronics and Communication Engineering **Sem: 3 Category: PC**

Aim: To verify the circuit theorem and study the characteristics of electronic devices.

Course Outcomes: The students will be able to

CO1: Analyze network theorems using T, π and impedance Matching Networks.(AN)
CO2: Construct filter circuits. (AP)
CO3: Analyze the characteristics of RLC circuits.(AN)
CO4: Analyze the characteristics of voltage regulators. (AN)
CO5: Interpret the Device behaviour of BJT and JFET. (UN)
CO6: Examine the characteristics of LED, PIN, Photo Diode.(AN)

List of Experiments

1. Construct and analyze of T, π and impedance Matching Networks using Network Theorems.
2. Construct and analyze of LPF & HPF using RC and LC Circuits.
3. Determination of Q factor of parallel and series LC circuit.
4. Construct a half wave and full wave rectifier using diodes.
5. Design and analyze the characteristics of Voltage Regulators.
6. Design and analyze filter circuit (L & C) for rectification.
7. Analyze the input and output characteristics of Bipolar Junction Transistor and JFET.
8. Analyze the V-I characteristics of LED, LDR, Photo diode and PIN Diode.

Total Periods 60

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	2				3	1		1	3	3		1
CO2	3	3	3	3	2	1			3	1	1	2	3	3		1
CO3	3	3	2	3	2	2			3	1	1	2	3	3		1
CO4	3	2	2	3	2	1			3	1	1	2	3	2		1
CO5	3	2	3	3	2	1			3	1	1	2	3	3		2
CO6	3	2	3	3	2				3	1	1	2	3	3		2
CO7	3	3	3	2	3				3	1	1	3	2	2		1

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC38 LINEAR INTEGRATED CIRCUITS LABORATORY L-T-P C
0-0-2 1

Programme: B.E. - Electronics and Communication Engineering **Sem: 3 Category: PC**

Aim: To acquire skills in designing and implementation of Op – Amp applications

Course Outcomes: The students will be able to

CO1: Implement the Op-Amp Configurations.(UN)
CO2: Construct Differential amplifier circuit.(AP)
CO3: Build applications of Op-Amp.(AP)
CO4: Develop waveform generator circuits using Op-Amp and timer ICs..(AP)
CO5: Apply the characteristics of PLL to design frequency multiplier.(AP)
CO6: Construct regulator and converter circuits.(AP)

List of Experiments 9

1. Design and Implementation of Inverting, Non inverting and differential amplifier configurations of IC741.
2. Design and Implementation of applications of Op Amp IC741.
    a. Integrator and Differentiator.
    b. Voltage Follower
    c. V to I and I to V converters
    d. Arithmetic operations
    e. Instrumentation Amplifier,
3. Astable multivibrator and Schmitt Trigger using Op-amp IC741.
4. Astable and Monostable multivibrators using NE555 Timers.
5. Phase shift and Wien bridge oscillators using op-amp.
6. PLL characteristics and its use as Frequency Multiplier.
7. Design and implementation of a DC-DC Converter.
8. Design and implementation of a Low Dropout Regulator.

Total Periods 60

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	3				3	1	2	2	2	3	3	2
CO2	3	2	2	2	3				3	1	2	2	2	3	2	2
CO3	2	3	2	3	3	2			3	1	2	2	2	3	2	3
CO4	3	3	3	3	3				3	1	2	2	2	3	3	2
CO5	2	2	2	2	3				3	1	2	2	3	3	3	2
CO6	3	3	2	2	3	1			3	1	2	2	2	3	3	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191HS41 PROBABILITY AND RANDOM PROCESSES L-T-P C
2-1-0 3

Programme: B.E.-Electronics and Communication Engineering **Sem: 4 Category: BSC**

Aim: To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems etc in communication engineering.

Course Outcomes: The students will be able to

CO1: Classify the discrete and continuous random variables (AP)
CO2: Analyze the binomial, Poisson, geometric, uniform, exponential and normal distribution (AN)
CO3: Understanding the Two dimensional Random Variables (UN)
CO4: Determine strictly stationary, wide–sense stationary and Poisson process (AP)
CO5: Examine Wiener - khintchine relation and correlation properties (AN)
CO6: Determine Auto correlation and Cross correlation functions (AP)

PROBABILITY AND RANDOM VARIABLES **9**

Probability spaces – Conditional probability – Bayes rule - Discrete and continuous random variables – Moments - Moment generating functions and their properties.

DISCRETE AND CONTINOUS PROBABILITY DISTRIBUTION **9**

Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and normal distributions – Function of Random Variable

TWO DIMENSIONAL RANDOM VARIBLES **9**

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem (for 2-D random variables)

CLASSIFICATION OF RANDOM PROCESSES **9**

Definition and examples - first order, second order, strictly stationary, wide-sense stationary and ergodic processes - Markov process - Binomial, Poisson and Normal processes - Sine wave process – Random telegraph process.

CORRELATION AND SPECTRAL DENSITIES **9**

Auto correlation - Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function

TOTAL PERIODS 45

Text Book

1. Oliver C. Ibe, “Fundamentals of Applied probability and Random processes”, Elsevier, First Indian Reprint (2007) (For units 1 and 2)
2. Peebles Jr. P.Z., “Probability Random Variables and Random Signal Principles”, Tata McGraw-Hill Publishers, Fourth Edition, New Delhi, 2002. (For units 3, 4and 5).

Reference

1. Miller,S.L and Childers, S.L, “Probability and Random Processes with applications to Signal Processing and Communications”, Elsevier Inc., First Indian Reprint 2007.
2. H. Stark and J.W. Woods, “Probability and Random Processes with Applications to Signal

Processing", Pearson Education (Asia), 3rd Edition, 2002.
3. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw-Hill edition, New Delhi, 2004.
4. Leon-Garcia,A, "Probability and Random Processes for Electrical Engineering", Pearson Education Asia, Second Edition, 2007.
5. Yates and D.J. Goodman, "Probability and Stochastic Processes", John Wiley and Sons, Second edition, 2005.

Course outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	P02	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3				1					1				3	
CO2	1	2	2				2					1		2		
CO3	2	1	2										1			1
CO4	1	2	2			2				1					1	
CO5		1	2			2								1		
CO6		1	3			1	2				2		2			

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC41 **ANALOG ELECTRONICS** **L-T-P** **C**

3-0-0 **3**

Programme: B.E. - Electronics and Communication Engineering **Sem:** **4** **Category:** **PC**

Aim: To enable the students to learn about the uses of transistors in analog circuits like single and multistage amplifier, feedback amplifier, Differential amplifier, power amplifier and oscillators. It also gives information about the current mirror circuits used for biasing in Integrated Circuits and their applications in the field of electronics industry.

Course Outcomes: The students will be able to

CO1: Explain the frequency response of BJT and FET. (UN)

CO2: Interpret the characteristics of single stage and multi stage amplifiers. (UN)

CO3: Illustrate the principles of feedback amplifiers. (UN)

CO4: Explain various amplifier connections. (UN)

CO5: Develop frequency of oscillation for different oscillators. (AP)

CO6: Summarize the operation of various types of power amplifiers.(UN)

BJT AND JFET FREQUENCY RESPONSE **9**

Low frequency response – BJT Amplifier, FET Amplifier, Miller effect capacitance, High frequency response – BJT Amplifier, FET Amplifier, Multistage Frequency Effects.

9

SINGLE STAGE AND MULTISTAGE AMPLIFIERS

Single stage amplifiers – Different configurations and their frequency response – Need for multistage amplifier –Differenttypes of multistage amplifier - Cascade amplifiers, Cascode amplifiers, Darlington amplifier - Gain of multistage amplifier.

9

FEEDBACK AMPLIFIERS

Basic principles and types of feedback- Negative feedback amplifiers - Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier – Types of negative feedback amplifiers – Measurement of gain with and without feedback.

OSCILLATORS AND MULTIVIBRATORS **9**

Barkhausen criterion foroscillations –Types of oscillators – Hartley, Colpitts, tuned collector, crystal oscillator, RC phase shift and Wien bridge - Multivibrators, Schmitt Trigger and sawtooth waveform generator using BJT.

9

TUNED AMPLIFIERS AND LARGE SIGNAL AMPLIFIER

Single and double tuned voltage amplifiers and their frequency response - Difference between voltage and power amplifiers -Importance of impedance matching in amplifiers - Classification of large signal amplifiers - Class A,B,C and Class AB amplifiers - Push-pull class B amplifier and complementary symmetry push-pull amplifier.

TOTAL PERIODS **45**

Text Book:

1. Adel S. Sedra and Kenneth C.Smith, “Microelectronic Circuits”, Oxford University Press, 6th Edition, 2014.

References:

1. Behzad Razavi, "Fundamentals of Microelectronics", 2nd edition, Wiley publication,2013.
2. Millman & Halkias, "Integrated Electronics", 48th reprint, Tata McGraw Hill, 2008.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	2	1						2	2	3		2
CO2	3	2	3	2	1	1						2	2	3		2
CO3	3	2	3	3	2	1						2	2	3	2	2
CO4	3	2	3	3	1	1						2	2	3	2	2
CO5	3	3	2	3	2	1						2	2	3	2	2
CO6	3	2	3	3	2	1						2	2	3	2	2

Entercorrelationlevels1,2or3as defined below:1:Slight (Low)2:Moderate(Medium)3:Substantial(High)

191EC42	SIGNALS AND SYSTEMS			L-T-P	C
				3-1-0	4
Programme:	B.E. - Electronics and Communication Engineering	**Sem:**	4	**Category:**	PC

Aim: To study and analyze the characteristics of continuous, discrete signals and systems.

Course Outcomes: The students will be able to

CO1: Explain the Principles & Properties of Signals and Systems. (UN)
CO2: Compute the Fourier series & Fourier transforms of the sinusoidal signals. (AP)
CO3: Make use of CT systems in the frequency domain using Fourier analysis. (AP)
CO4: Apply Laplace transform to Continuous Time Systems. (AP)
CO5: Summarize Z transform and DTFT to characterize Discrete time systems. (UN)
CO6: Utilize DFT for the Discrete Signals. (AP)

CLASSIFICATION OF SIGNALS AND SYSTEMS **12**

Basic signals, Classification of signals – Continuous and Discrete signals, Periodic and Aperiodic signals, Deterministic and Random signals, Energy and Power signals – Classification of systems – Continuous and Discrete systems, Static and Dynamic, Linear and Nonlinear, Time-variant and Time-invariant, Causal and Non causal, Stable and Unstable, linear and circular convolution.

ANALYSIS OF CONTINUOUS TIME SIGNALS **12**

Fourier series analysis - Fourier and Laplace Transforms– Properties of Fourier and Laplace Transforms.

LINEAR TIME INVARIANT- CONTINUOUS TIME SYSTEMS **12**

Differential Equation-Block diagram representation-impulse response, convolution integrals-Laplace transform in Analysis of CT systems.

ANALYSIS OF DISCRETE TIME SIGNALS **12**

Baseband Sampling – Aliasing, Reconstruction of CT signal from DT signal- DTFT & its properties - Z Transform & its Properties.

LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS **12**

Difference Equations-Block diagram representation-Impulse response – Convolution sum-. Discrete Fourier Transform, Properties of DFT, FFT, Radix 2 DIF-FFT, Radix 2 DIT-FFT.

Total Periods: 60

Text Book:

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, Signals and Systems, PHI, 2nd Edition, 2008
2. Anand Kumar, Signals and Systems - PHI; 3rdedition, 2013

References:

1. Simon Haykin and Van Veen, Signals & Systems, Wiley, 3rd Edition, 2007.
2. Michel J. Robert, Fundamentals of Signals and Systems, MGH International Edition, 2008.
3. B.P. Lathi, Signals, Systems & Communications, BS Publications, 2008.
4. Narayan Iyer and K Satya Prasad,Signals& Systems, Cenage Pub, 2011.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	1							2	3		3	1
CO2	3	3	2	2	2							2	3		3	1
CO3	3	3	3	3	2							2	3		3	2
CO4	3	3	3	3	2							2	3		3	2
CO5	3	3	3	3	2							2	3		3	2
CO6	3	3	3	2	2							2	2	2	3	2

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191EC43	DIGITAL SYSTEMS			L-T-P	C
				3-0-0	3
Programme:	B.E. - Electronics and Communication Engineering	**Sem:**	**4**	**Category:**	**PC**

Aim: The course aims at Circuit schematic development, Computer modelling, Simulation of digital system and verifies their functionality using the Hardware description Language (Verilog).

Course Outcomes: The students will be able to

CO1: Explain the different types of numbering systems (UN)

CO2: Minimization of any Boolean expressions using K-map Queen Mc-Cluskey method (UN)

CO3: Design combinational circuits. (AP)

CO4: Design sequential circuits. (AP)

CO5: Build the logic families. (AP)

CO6: Develop the HDL Programs for digital circuits. (AP)

NUMBER SYSTEM & MINIMIZATION TECHNIQUES **9**

Number system , Binary Arithmetic Operation , 1's and 2's complements,9's and 10's complement, Classification of binary Codes, Boolean logic operations and laws, De-Morgan's Theorem, Minimization of Boolean expressions , Sum of Products (SOP) , Product of Sums (POS), Karnaugh map Minimization (Three & Four variable), Quine-Mc Cluskey method.

LOGIC GATES & COMBINATIONAL CIRCUITS **9**

Logic Gates, Mixed Logic, Half adder & Half Subtractor , Full Adder & Full Subtractor , Parallel binary adder, Parallel binary Subtractor, Fast Adder, Binary Multiplier, Binary Divider, Multiplexer / Demultiplexer, Decoder / Encoder , Parity checker, Parity generators , Code converters, Magnitude Comparator.

SEQUENTIAL CIRCUITS **9**

Flip-flops – SR, JK, D, T, and Master-Slave, Characteristic table and equation, Triggering of flip flops, Realization of one flip flop using other flip flops. Counters – Asynchronous & Synchronous Up/Down counter. Registers – Shift registers, Shift register counters. Design using Algorithmic State Machines and Finite State Machines, Design of Hazard Free Switching circuits.

MSI AND PLD COMPONENTS **9**

Registers, basics of architecture - Fixed-function devices-TTL, ECL, RTL, CMOS, RAM/ROM, Programmable devices-PROMs, PALs and PLDs, FPGAs.

COMPUTER-AIDED DESIGN **9**

Hardware description languages (HDLs) - Introduction to Verilog, Logic compilation, Two-level and multi-level logic synthesis, Technology-independent optimization, Technology mapping, Sequential-logic synthesis.

Total Periods 45

Text Book:

1. M.Morris Mano, Digital Design, 5th Edition, Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2013.

References:

1. Donald D.Givone, Digital Principles and Design, TMH, 2007.
2. Donald P.Leach, Albert Paul Malvino, Goutam Shah "Digital principles & applications",7th edition, 2011.
3. S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 3rd edition, Vikas Publishing House Pvt. Ltd, New Delhi, 2007.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2	1							2	2	3		2
CO2	2	3	2	2	2							2	2	3		2
CO3	3	3	3	3	2	1			3		1	2	2	3		2
CO4	3	3	3	3	2	1			3		1	2	2	3		2
CO5	3	3	3	2	2	1						2	2	3		2
CO6	2	3	3	2	1							2	2	3		2

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191EC44 ELECTROMAGNETIC FIELDS AND WAVEGUIDES L-T-P C
3-1-0 4

Programme: B.E. - Electronics and Communication Engineering **Sem: 4 Category: PC**

Aim: To understand the concepts, calculations and pertaining to electric, magnetic and electromagnetic fields.

Course Outcomes: The students will be able to

CO1: Summarize the coordinate system and apply conversion between them. (UN)

CO2: Interpret the fundamentals of static electric field with source equation. (UN)

CO3: Interpret the fundamentals of static magnetic fields. (UN)

CO4: Develop Maxwell's equations for static and time varying fields.(AP)

CO5: Analyze the wave equation and waves in different media. (AN)

CO6: Analyze the characteristics of waveguide. (AN)

ELECTROSTATIC FIELDS 9

Vector addition and subtraction, Dot and cross products, Line and surface integrals, Introduction to differential operators, Cartesian, cylindrical, and spherical coordinates, Coulomb's law and electric field intensity, The source equation; divergence, Gauss' law, Ohm's law, Electrostatic energy and potential gradient, Capacitors, Boundary condition on the normal electric field, Laplace's and Poisson's equations, Laplacian.

MAGNETIC FIELDS AND TIME VARYING FIELDS 9

Magnetic Fields: Ampere's work law in differential vector form, Ampere's law for a current element. Magnetic vector Potential, Magnetic scalar Potential, Magnetic dipole, Energy and Mechanical forces in magnetic fields, Image of current carrying conductor in the neighborhood of a magnetic plane.

Time-Varying Fields: Faraday's law, Boundary condition on the tangential electric field, Maxwell's equations, Skin effect.

ELECTROMAGNETIC WAVES 9

Derivation of the wave equation and their general solution, Reflection and refraction of plane waves at surface interface, surface impedance, Poynting Vector and Flow of Power,Poynting's theorem, Power Loss in a plane conductor.

GUIDED WAVES 9

Characteristics of TE and TM waves, wave impedance, impedance matching by means of stab lines, TE and TM waves in circular guides

WAVE GUIDES 9

Introduction to wave guides, Circuits, line and guides – a comparison, Rectangular and circular wave guides, TE and TM waves in rectangular wave guides, Impossibility of TEM waves in wave guides, Wave impedances and characteristics impedances, Attenuation and Q-factor of wave guides.

Total Periods 45

Text Book:

1. Jordon E C and Balmain K G, "Electromagnetic waves and Radiating System", Prentice Hall New Delhi (2003).
2. Hayt W H, "Engineering Electromagnetics", McGraw Hill Book Co, Eighth Edition, NY (2010)

References:

1. F.T. Ulaby and U. Ravaioli, Fundamentals of Applied Electromagnetics, 7th edition, Pearson, 2015
2. Griffiths, David J. Introduction to electrodynamics, 4th edition., international edition: Boston: Pearson, cop. 2013
3. Mathew N.O.Sadiku, "Principles of Electromagnetics", Oxford Press Int. Edition, 2009.
4. Jian –Ming Jin, "Theory and Computation of Electromagnetic Fields", IEEE Press 2015.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3		2							3	2	3	2
CO2	3	3	2	2		2						1	3	2	3	2
CO3	3	3	2	2		2						2	3	2	3	2
CO4	3	3	3	2	2	2						2	3	2	3	2
CO5	3	3	3	2	2	2						2	3	2	3	2
CO6	3	3	2	2	2	2						2	3	2	3	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191CS46 **PYTHON PROGRAMMING** **L T P C**
3 0 2 4

Programme: BIOTECH / ECE / EEE **Sem: 4** **Category: ESC**

Aim: To provide students with the programming knowledge and to develop python programs.

Course Outcomes: The Students will be able to

CO1: Illustrate the fundamentals of python programming. (UN)
CO2: Explain functions in python. (UN)
CO3: Interpret strings and lists in python programs. (AP)
CO4: Utilize OOPS Concept in python. (AP)
CO5: Infer the classes and objects. (UN)
CO6: Explain the tuples, dictionaries, files and exceptions in python. (UN)

INTRODUCTION **9**

Python Overview - Comments - Identifiers - Keywords - Variables - Data types - Operators - Statement and Expressions - String Operations - Boolean Expressions - Control Statements -Iterations - Input from Keyboard.

FUNCTIONS IN PYTHON **9**

Built-in Functions - Composition of Functions - User defined functions - Parameters and Arguments - Function calls - The return statement - Python recursive function - Anonymous Functions.

STRINGS AND LISTS **9**

Strings - Compound Data Types - String slices - String Traversal - Escape Characters - String formatting operator, functions - Lists-Traversing a List - Built-in list operators, methods.

CLASSES AND OBJECTS **9**

Class, Objects in python - Built-in Class attributes - Inheritance - Method Overriding - Data Encapsulation - Data hiding.

DICTIONARIES AND FILES **9**

Tubles-Values - Operations - Functions - Dictionaries - Values - Update - Properties Operations - Files - Text Files - Exceptions - Exception with arguments - User defined Exceptions.

Lab Component:

Write the programs for the following topics using python:

1. Operators
2. Control Statements
3. Built-In and User defined functions
4. String functions
5. List functions.
6. Classes and their attributes.
7. Inheritance and method overriding.
8. Data Encapsulation and hiding.
9. File Operations and Exception handling.

Total Periods(45+15): 60

Text Books:

1. E.Balagurusamy, ”Introduction to Computing And Problem Solving Using Python”, Mc-GrawHill Education (India) Private Ltd., 2016.

References:

1. MarkLutz, ”Programming Python”, Fourth Edition, 2010.
2. John V.Guttag, ”Introduction to Computation and Programming using Python”, Second Edition,

2016.
3. John Paul Mueller, ”Beginning Programming with python For DUMMLES”, 2014.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1		1			3	3	3	2			1	
CO2	3	2	2	1		2			3	3	3	1			2	
CO3	2	3	2	2		2			2	2	3	1			2	
CO4	1	3	2	2	2	1			2	2	1	1			2	
CO5	2	2	2	2	1	2			2	1	2	1			3	
CO6	1	3	3	2	2	2			2	2	2	1			3	

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191EC47 ANALOG ELECTRONICS LABORATORY L-T-P C
0-0-2 1

Programme: B.E. - Electronics and Communication Engineering **Sem: 4 Category: PC**

Aim: To design and implement analog electronic circuits.

Course Outcomes: The students will be able to

CO1: Analyze the frequency response of amplifier circuits. (UN)
CO2: Construct the differential amplifier. (AP)
CO3: Design oscillator circuits. (AP).
CO4: Build power amplifier circuit. (AP)
CO5: Construct amplifier circuits using simulation software.(AP)
CO6: Develop waveform generation circuits using simulation software.(AP)

List of Experiments

1. Design, construct and analyze Single Stage common emitter amplifier also obtain the Frequency Response.
2. Design, Construct and analyze a Differential pair circuit also calculate a CMRR value
3. Design, Construct and analyze a Multistage Amplifier also obtain the Frequency Response of an Amplifiers - Cascade and Darlington Amplifier
4. Design, Construct and test a feedback amplifier also compare the Frequency analysis using with and without Feedback - Voltage Shunt and Current series
5. Design, Construct and test a sinusoidal and square waveform generators and also Compare Theoretical and Practical Frequencies.
   a) RC Oscillators – RC Phase Shift
   b) LC Oscillators – Hartley and Colpitts
   c) Astable and Monostable Multivibrators
6. Frequency response of Tuned amplifier circuit.
7. Design, construct and analyze a Class "B" Power amplifier.
8. Simulation Experiments:
   i) Common Emitter and Common Collector Amplifiers
   ii) Darlington Amplifier
   iii) Voltage shunt feedback amplifier
   iv) Hartley and Colpitts
   v) Bistable Multivibrators
9. Mini project

Total Periods 60

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	2	2			3	1		2	2	3		2
CO2	3	2	3	3	2	3			3	2		2	2	3	2	3
CO3	3	2	3	3	2	2			3	2	2	2	2	3	2	2
CO4	3	2	3	3	2	2			3	2	2	2	2	3	3	2
CO5	3	3	2	3	2	2			3	2	2	2	2	3	3	2
CO6	3	2	3	3	2	3			3	2	2	2	2	3	3	2

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191EC48 DIGITAL SYSTEMS LABORATORY L-T-P C
0-0-2 1

Programme: B.E. - Electronics and Communication Engineering **Sem: 4 Category: PC**

Aim: To design, simulate and implement combinational and sequential circuits.

Course Outcomes: The students will be able to

CO1: Construct arithmetic and logic circuits using logic gates. (AP)

CO2: Build various combinational logic circuits using logic gates (AP)

CO3: Design the sequential logic circuits by using flip flops (AP)

CO4: Illustrate various types of code converters like binary to gray code converter and seven segment display code converter.(UN)

CO5: Explain the working of parity generators and counters. (UN)

CO6: Develop adders, multiplexers and counters using behavioral level modeling. (AP)

List of Experiments

Software Experiments using HDL

1. Design and Simulation of Full adder circuit using Gate level modeling.
2. Design and Simulation of 2X2 multiplier circuit using structural level modeling.
3. Design and Simulation of 8 to 1 Multiplexer circuit using behavioural level modeling.
4. Design and Simulation of up-down counter using behavioural level modeling.

Hardware Experiments

1. Implement arithmetic and logic circuits using logic gates.
2. Implementation of Full Adder using(a) Decoder(b) Multiplexer.
3. Implementation of various types of code converters like binary to gray code converter and seven segment display code converter.
4. Implementation of SR, D, T, and JK flipflops and basic counters.
5. Implementation of odd and even parity generators.

Total Periods 60

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	2	3				3	1	2	2	2	3	3	2
CO2	3	2	2	2	3				3	1	2	2	2	3	2	2
CO3	2	3	2	3	3	2			3	1	2	2	2	3	2	3
CO4	3	3	3	3	3				3	1	2	2	2	3	3	2
CO5	2	2	2	2	3				3	1	2	2	3	3	3	2
CO6	3	3	2	2	3	1			3	1	2	2	2	3	3	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC51 ANALOG AND DIGITAL COMMUNICATION L T P C
3 0 0 3

Programme: B.E. Electronics and Communication Engineering **Sem: 5 Category: PC**

AIM: To analyze the various analog and digital modulation and demodulation techniques, transmitters & receivers used in communication systems.

Course Outcomes

CO1: Compare various amplitude modulation techniques. (UN)
CO2: Develop the various frequency modulation techniques. (AP)
CO3: Explain the different waveform encoding process. (UN)
CO4: Develop the various techniques used in the channel and source coding process. (AP)
CO5: Explain the various digital modulation techniques. (UN)
CO6: Demonstrate the spread spectrum and multiple access techniques. (UN)

AMPLITUDE MODULATION **9**

Need for modulation, Amplitude modulation, Virtues and limitations of Amplitude modulation, Linear modulation schemes, DSB-SC Modulation, Coherent detection, Costas receiver, Quadrature carrier multiplexing, SSB Modulation, vestigial side band modulation, Television signals, Frequency translation, Comparison of amplitude modulation systems.

ANGLE MODULATION **9**

Frequency and phase modulation. spectrum of FM Wave, modulation index and Bandwidth of FM Signal, NBFM and WBFM, Comparison between FM and PM Signals, FM and AM signals, AM and NBFM Signals, Generation of FM signals, Demodulation of FM signals, slope detector, ratio detector, Foster Seeley discriminator, Pre-emphasis & De-emphasis, – Capture effect, threshold effect, Super heterodyne radio receiver and its characteristics.

DIGITAL TRANSMISSION AND DATA COMMUNICATION **9**

Introduction, pulse modulation, PCM – PCM sampling, sampling rate, signal to quantization noise rate, companding – analog and digital – percentage error, delta modulation, adaptive delta modulation, differential pulse code modulation, pulse transmission – ISI, eyepattern, source and error control coding, Entropy, Source encoding theorem, Shannon Fano coding, Huffman coding, mutual information, channel capacity, channel coding theorem,Error control coding, linear block codes, cyclic codes, convolution codes, viterbi decoding algorithm.

DIGITAL COMMUNICATION **9**

Introduction, Shannon limit for information capacity, digital amplitude modulation, frequency shift keying, FSK bit rate and baud, FSK transmitter, BW consideration of FSK, FSK receiver, phase shift keying – binary phase shift keying – QPSK, Quadrature Amplitude modulation, bandwidth efficiency, carrier recovery – squaring loop, Costas loop, DPSK.

SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES **9**

Introduction, Pseudo-noise sequence, DS spread spectrum with coherent binary PSK, processing gain, FH spread spectrum, multiple access techniques – wireless communication, TDMA and FDMA, wireless communication systems, source coding of speech for wireless communications.

Total Periods: 45

TEXT BOOKS

1. Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Edition, Pearson Education, 2009.

REFERENCES

1.Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons, 2004
2. Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2007
3. H.Taub, D L Schilling and G Saha, "Principles of Communication", 3rd Edition, Pearson Education, 2007.
4. B. P.Lathi, "Modern Analog and Digital Communication Systems", 3rd Edition, Oxford University Press, 2007.
5. Blake, "Electronic Communication Systems", Thomson Delmar Publications, 2002.
6. Martin S.Roden, "Analog and Digital Communication System", 3rd Edition, Prentice Hall of India, 2002.
7. B.Sklar, "Digital Communication Fundamentals and Applications" 2nd Edition Pearson Education 2007.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3	3							2	3	3	2	2
CO2	3	2	2	2								2	3	2	2	2
CO3	3	2	2	2	3	2	2					2	3	3	2	2
CO4	3	2	2	2								2	3	2	2	2
CO5	3	3	2	2	2	3	2					2	3	2	2	2
CO6	3	2	2	2	3	2						3	3	3	2	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EE42	CONTROL SYSTEMS	L-T-P	C
		3-0-0	3

Programme: B.E – Electronics and Communication Engineering **Sem: 5** **Category: PC**

AIM: To provide sound knowledge in the basic concepts of linear control theory and design of control system.

Course Outcomes:

The Students will be able to

CO1: Develop various representations of the system. (AP)
CO2: Explain time response analysis for I and II order systems. (UN)
CO3: Explain various methods of frequency domain analysis. (UN)
CO4: Identify the stability of the system. (AP)
CO5: Build the suitable compensator for given specifications. (AP)
CO6: Identify the solution of complex control problem by state variable analysis. (AP)

SYSTEMS AND REPRESENTATION **9**

Basic elements in control systems: – Open and closed loop systems – Electrical analogy of mechanical systems – Transfer function – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

TIME DOMAIN ANALYSIS **9**

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error.

FREQUENCY DOMAIN ANALYSIS **9**

Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

STABILITY AND COMPENSATOR DESIGN **9**

Concept of Stability - Routh-Hurwitz Criteria - Root-Locus technique - Nyquist stability criterion - Design of Lag, lead compensator using bode plots.

STATE VARIABLE ANALYSIS **9**

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability.

Total Periods 45

Text Books

1. Nagarath, I.J. and Gopal, M., “Control Systems Engineering”, New Age International Publishers, 2017
2. Katsuhiko Ogata, “Modern Control Engineering”, Pearson, 2015.

References

1. Benjamin C. Kuo, “Automatic Control Systems”, Wiley, 2014
2. M.Gopal, “Control System: Principle and design”, McGraw Hill Education, 2012.
3. A. NagoorKani, Control Systems, RBA Publications, 2017.
4. NPTEL Course on “Control Engineering” by Prof. S. D. Agashe, IIT Bombay.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	2			1				2	1	3	2	2	3
CO2	3	2	3	2							2		3		2	3
CO3	3	2	3	2							1		3		2	3
CO4	3	2	3	2			1				1	1	3		2	3
CO5	3	3	3	1							2		3		2	3
CO6	3	2	2	1							1		3		2	3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC52 ANTENNAS AND MICROWAVE ENGINEERING

L	T	P	C
3	0	0	3

Programme: B.E. Electronics and Communication Engineering **Sem: 5** **Category: PC**

AIM: To enable the student to understand the basic principles in antenna and microwave system design

Course Outcomes

CO1: Explain the parameters of Antenna. (UN)
CO2: Interpret the radiation mechanism of Antenna. (UN)
CO3: Develop the applications of Antenna Arrays. (AP)
CO4: Explain the principles of active microwave devices. (UN)
CO5: Infer about passive microwave devices. (UN)
CO6: Design of Microwave Amplifiers. (AP)

INTRODUCTION TO MICROWAVE SYSTEMS AND ANTENNAS

Microwave frequency bands, Physical concept of radiation, Near- and far-field regions, Fields and Power Radiated by an Antenna, Antenna Pattern Characteristics, Antenna Gain and Efficiency, Aperture Efficiency and Effective Area, Antenna Noise Temperature and G/T, Impedance matching, Friis transmission equation, Link budget and link margin, Noise Characterization of a microwave receiver.

RADIATION MECHANISMS AND DESIGN ASPECTS

Radiation Mechanisms of Linear Wire and Loop antennas, Aperture antennas, Reflector antennas, Microstrip antennas and Frequency independent antennas, Design considerations and applications.

ANTENNA ARRAYS AND APPLICATIONS

Two-element array, Array factor, Pattern multiplication, Uniformly spaced arrays with uniform and non-uniform excitation amplitudes, Smart antennas.

PASSIVE AND ACTIVE MICROWAVE DEVICES

Microwave frequencies- Microwave Systems-Microwave Applications -Scattering matrix - Concept of N port scattering matrix representation- Properties of S matrix - S matrix formulation of two-port junction- Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, attenuator, resonator, Principles of Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes, Microwave tubes: Klystron, TWT, Magnetron.

MICROWAVE DESIGN PRINCIPLES

Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design.

TOTAL PERIODS45

TEXT BOOKS

1. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation: Fourth Edition, Tata McGraw-Hill, 2006.

REFERENCES

1. David M. Pozar, "Microwave Engineering", Fourth Edition, Wiley India, 2012.
2. Constantine A.Balanis, ―Antenna Theory Analysis and Design‖, Third edition, John Wiley India Pvt Ltd., 2005. 2. R.E.Collin, "Foundations for Microwave Engineering", Second edition, IEEE Press, 2001

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2							1	3	2		2
CO2	3	3	3	2	2							2	3	2		2
CO3	3	3	3	3	2	2						2	3	2		2
CO4	3	3	2	2	2							2	3	2	2	2
CO5	3	2	3	2	2	2						2	3	2	2	2
CO6	3	3	3	2	2	3						2	3	2	2	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC53 DIGITAL SIGNAL PROCESSING ANDA RCHITECTURE

L	T	P	C
3	1	0	4

Programme: B.E. Electronics and Communication Engineering **Sem: 5** **Category: PC**

AIM: To design and implement IIR and FIR filters in digital signal processors

Course Outcomes

CO1: Design digital IIR Butterworth and Chebyshev filters. (AP)
CO2: Construct digital FIR filters using windowing technique. (AP)
CO3: Analyze the power spectrum using parametric and non-parametric methods. (UN)
CO4: Explain finite word length effects.(UN)
CO5: Illustrate the functionalities of digital signal processors. (UN)
CO6: Interpret the architecture and programming of TMS processors. (UN)

INFINITE IMPULSE RESPONSE FILTERS **12**

Review of DFT, FFT, Characteristics of practical frequency selective filters. characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

FIR FILTER DESIGN **12**

Symmetric and Antisymmetric FIR filters - Linear phase FIR filter - Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window and Blackmann Windows), Frequency sampling techniques - Realization of FIR filters – Transversal, Linear phase and Polyphase structures.

POWER SPECTRUM ESTIMATION **12**

Estimation of spectra from Finite duration observation of signals, non- parametric methods for power spectrum estimation -Welch, Bartlett methods, parametric methods for power spectrum estimation -Yule-Walker method for the AR model parameters

FINITE WORD LENGTH EFFECTS **12**

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

INTRODUCTION TO DIGITAL SIGNAL PROCESSORS **12**

DSP functionalities - circular buffering – DSP architecture – Fixed and Floating point architecture principles, Introduction to ADSP- 2100 family of processors – Programming – Architecture of DSP chip TMS320C54x and TMS320C55x, TMS320C6X DSP chip CPU Operation

TOTAL PERIODS60

TEXT BOOKS

1. John G. Proakis&Dimitris G.Manolakis, Digital Signal Processing – Principles, Algorithms & Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.

REFERENCES

4. Emmanuel C.Ifeachor& Barrie. W. Jervis, Digital Signal Processing, Second Edition, Pearson Education / Prentice Hall, 2002.
5. A. V. Oppenheim, R.W. Schafer and J.R. Buck, Discrete-Time Signal Processing, 8th Indian Reprint, Pearson, 2004.
3. Sanjit K. Mitra, Digital Signal Processing – A Computer Based Approach, Tata Mc Graw Hill, 2007.
4. Andreas Antoniou, Digital Signal Processing, Tata Mc Graw Hill, 2006.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3							2	2		3	
CO2	3	3	3	3	3							2	2	2	3	2
CO3	3	3	3	3	3							2	2	2	3	2
CO4	3	3	2	2	2							2	2		3	
CO5	3	3	2	3	3							2	2	2	2	2
CO6	3	3	2	3	3							2	2	2	2	2

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191EC54 EMBEDDED SYSTEMS AND IOT

L	T	P	C
3	0	2	4

Programme: B.E. Electronics and Communication Engineering **Sem: 5** **Category: PC**

AIM: To design and develop embedded computer systems to adopt IoT.

Course Outcomes

CO1: Interpret the general computing system and the embedded system.(UN)
CO2: Summarize various device drivers for embedded products.(UN)
CO3: Illustrate the operations of different embedded busses and interrupt servicing mechanism.(UN)
CO4: Construct real time embedded systems using the concepts of RTOS.(AP)
CO5: Identify the internal design process of internet of things.(AP)
CO6: Develop program for the internet of things modules.(AP)

INTRODUCTION TO EMBEDDED SYSTEMS **9**

Review of 8085, 8086, 8051 –Definition and Classification – Characteristics of embedded systems – Challenges of embedded systems – Overview of processors and hardware units in an embedded system – Software embedded into the system – Exemplary embedded Systems – Embedded system design process.

DEVICES DRIVERS ,BUSES AND INTERRUPT SERVICING MECHANISM **9**

Overview of Embedded programming in ALP and C – Device drivers – Parallel port device drivers in a system- Serial port device drivers in a system- Device drivers for internal programmable timing devices – Embedded Buses – 1^2C- USB and CAN Buses- Interrupt servicing mechanism – Context and period for context switching- Deadline and Interrupt latency

REAL TIME OPERATING SYSTEMS **9**

Definitions of process, tasks and threads –Operating system services- Goals and structures - Kernel services – Concept of semaphores - RTOS task scheduling models – Co-operative Round Robin scheduling – Cyclic scheduling with time slicing– Preemptive scheduling model – Critical section service by a preemptive scheduler – Fixed (static) real time scheduling of tasks – Priority inversion problem and deadlock situations.

INTERNET OF THINGS **9**

Definition – phases – Foundations – Policy– Challenges and Issues - identification - security – privacy. Components in internet of things: Control Units – Sensors – Communication modules – Power Sources – Communication Technologies – RFID – Bluetooth – Zigbee – Wifi – Rflinks – Mobile Internet – Wired Communication

PROGRAMMING THE MICROCONTROLLER FOR IOT **9**

Basics of Sensors and actuators – examples and working principles of sensors and actuators – Cloud computing and IOT – Arduino/ Equivalent Microcontroller platform – Setting up the board - Programming for IOT – Reading from Sensors Communication: Connecting microcontroller with mobile devices – communication through Bluetooth and USB – connection with the internet using wifi / Ethernet

LIST OF EXPERIMENTS:

1. Simple Assembly language programming using 8051.
2. Configuring and interfacing 8051 I/O ports using KEIL IDE.
3. Interfacing, Programming of Stepper Motor /Servo Motor& DC Motor Speed control.

4. Making different LED pattern design using Arduino Board.
5. Buzzer/LCD interface using Arduino Board
6. Basic Robotic Kit using TIVA processor and IoT
7. Voice Activate Robot using IoT

Total Periods 60

TEXT BOOKS

1. Rajkamal, "Embedded Systems Architecture, Programming and Design", Tata Mc Graw-Hill, 2nd Edition, 2009.
2. Dieter Uckelmann et.al, "Architecting the Internet of Things", Springer, 2011.

REFERENCES

1. Steve Heath, "Embedded Systems Design", 2nd Edition, Elsevier Publications, 2002.
2. David E-Simon, "An Embedded Software Primer", Pearson Education, 2007.
3. Frank Vahid and Tony Gwasrgie "Embedded system Design", John Wiley and Sons, 2002.
4. Wayne Wolf, "Computers as Components – Principles of Embedded Computer System Design", 3rd Edition Morgan Kaufmann Publisher, 2006.
5.Cuno Pfister, "Getting Started with the Internet of Things", O'Reilly, 2011.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	2	2			2			2	2	2		3
CO2	3	2	3	2	2	2			2			2	2	2		3
CO3	2	3	3	3	3	2			2			2	2	2		3
CO4	3	3	3	2	3	3			2		2	2	2	2		3
CO5	2	3	2	2	2	2			2			2	2	2		3
CO6	2	3	2	2	2	2			2			2	2	2	3	3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC57 COMMUNICATION SYSTEMS LABORATORY L-T-P C
0-0-2 1

Programme: B.E. Electronics and Communication Engineering **Sem:** 5 **Category:** PC

AIM: To expose the students in communication systems and microwave systems.

Course Outcomes: The students will be able to

CO1: Demonstrate the sampling and time division multiplexing. (UN)
CO2: Analyze different Modulation and demodulation techniques in communication systems. (UN)
CO3: Interpret various line coding schemes. (UN)
CO4: Classify various Error control coding. (UN)
CO5: Measure the characteristics of microwave sources and components. (AP)
CO6: Show the radiation pattern of horn antenna. (UN)

LIST OF EXPERIMENTS

1. Signal Sampling and reconstruction
2. Time Division Multiplexing
3. Amplitude and Frequency Modulation and Demodulation
4. Pulse Code Modulation and Demodulation
5. Delta Modulation and Demodulation
6. Line coding schemes
7. Generation of ASK, FSK and PSK schemes
8. Simulation of error control coding schemes - Linear Block Codes
9. Reflex Klystron or Gunn diode characteristics and basic microwave parameter measurement such as frequency, wavelength and attenuation.
10. Directional Coupler Characteristics.
11. Radiation Pattern of Horn Antenna.
12. S-parameter Measurement of the following microwave components (Isolator, Circulator, Magic Tee)

Total Periods: 45

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2				3	1	2	2	3		3	2
CO2	3	3	2	2	2	1			3	1	2	2	3	2	3	2
CO3	3	3	3	2	2				3	1	2	2	2	2	3	2
CO4	3	3	2	2	3	1			3	1	2	2	2		2	2
CO5	3	3	2	2	2				3	1	2	2	3		2	2
CO6	3	3	2	2	2	1			3	2	2	2	3	2	3	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC58 DSP AND PROCESSORS LABORATORY L-T-P C
0-0-2 1

Programme: B.E. Electronics and Communication Engineering **Sem:** 5 **Category: PC**

AIM: To develop skills in implementing digital signal processing techniques using MATLAB and Processors.

Course Outcomes: The students will be able to

CO1: Generate different continuous and discrete time waveforms. (UN)
CO2: Illustrate the algorithms of digital signal processing techniques like convolution and Fourier Transform. (UN)
CO3: Demonstrate the digital filter design. (AP)
CO4: Interpret the architecture of Digital Signal Processors. (UN)
CO5: Construct multirate filters. (AP)
CO6: Build adaptive filters for noise cancellation. (AP)

LIST OF EXPERIMENTS:

MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of sequences (functional & random)
2. Linear and Circular Convolutions
3. FIR filter design
4. IIR filter design
5. Multirate Filters
6. Determination of Power Spectrum of a given signal

DSP PROCESSOR BASED IMPLEMENTATION

1. Study the architecture of DSP chips – TMS320C5X/6X Instructions and its addressing modes
2. Generation of sine, square and triangular waveforms
3. Implementation of linear and circular convolution
4. Sampling of input signal and display
5. Implementation of FIR filter
6. Implementation of IIR filter
7. Implementation of Radix – 2 FFT using ADSP 21XX processor.
8. Adaptive filter for noise cancellation
9. Implementation of Multirate signal processing – Decimation and Interpolation filter

(Note: Experiments may be done using any one of the TMS320C5X/ TMS320C67XX/ ADSP21XX family of processors)

Total Periods60

Course Outcomes	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2				3	1	2	2	3	1	3	3
CO2	3	3	3	3	2				3	1	2	2	3	1	3	3
CO3	3	3	3	2	2				3	1	2	2	2	1	3	3
CO4	3	3	3	3	2				3	1	2	2	3	1	3	3
CO5	3	3	3	2	2				3	1	2	2	3	1	3	3
CO6	3	3	3	3	2	2			3	1	2	2	3	1	3	3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC61 WIRELESS COMMUNICATION L-T-P C
3-0-0 3

Programme: B.E. Electronics and Communication Engineering **Sem:** 6 **Category:** **PC**

AIM: To analyze and construct various Wireless communication systems.

Course Outcomes: The students will be able to

CO1: Infer the various modern wireless communication systems.(UN)
CO2: Explain the cellular concepts of wireless communication systems.(UN)
CO3: Interpret the wireless channel characteristics - path loss, propagation mechanisms.(UN)
CO4: Explain the small scale radio propagation models and prediction of their effects.(UN)
CO5: Classify the signal combining techniques, equalization and diversity. (UN)
CO6: Explain 4G network architecture and spatial multiplexing. (UN)

MODERN WIRELESS COMMUNICATION SYSTEMS 9

Introduction to Wireless Communication Systems, 2G and 3G Wireless Networks, WLL, LMDS, WLAN, Bluetooth and PAN, Principles of Cellular networks- Frequency reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grading of Service, Improving coverage and capacity in cellular systems.

LARGE SCALE PATH LOSS AND WIRELESS STANDARD 9

Free Space Propagation, Relating Power to Electric Field, Three Basic Propagation Mechanisms – Reflection, Diffraction and Scattering, Ground Reflection Model**,** Wireless Standard – GSM, IS 95.

SMALL SCALE FADING AND MULTIPATH PROPAGATION 9

Small Scale Multipath propagation, Parameters of mobile multipath channels, types of small scale fading, Rayleigh and Rician Distributions, Clarke's Model for flat fading.

SIGNAL PROCESSING IN WIRELESS SYSTEMS 9

Principle of Diversity, Macro diversity, Micro diversity, Signal Combining Techniques, Transmit diversity, Equalizers- Linear and Decision Feedback equalizers, Review of Channel coding and Speech coding techniques.

4G NETWORK ARCHITECTURE AND MIMO SPATIAL MULTIPLEXING 9

LTE – Evolution to 4G – Network Architecture -MIMO Spatial Multiplexing – MIMO capacity – Code words and Layer Mapping – Downlink MIMO transmission chain – MIMO Precoding – CDD based precoding – Open loop spatial multiplexing, 5G architecture.

Total Periods45

TEXT BOOK

1. Rappaport. T.S., "Wireless communications", Pearson Education,2nd edition, 2010.

REFERENCES

1.Andreas.F. Molisch, "Wireless Communications", John Wiley – India, Reprint 2008.
2. Sanjay Kumar ,'Wireless Communications Fundamental & Advanced Concepts', River Publishers, 2015
2.SimonHaykin& Michael Moher, "Modern Wireless Communications", Pearson Education, 2007.
3.Gordon L.Stuber, "Principles of Mobile Communication", Springer International Ltd.,3rdedition, 2011.
4.Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2007.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	1	2						2	3		2	
CO2	3	2	3	2	1	2						2	3		2	
CO3	3	3	2	2	1	2						2	3	1	2	
CO4	3	3	3	2	1	2	1					2	3	1	2	
CO5	3	3	3	2	1	2						2	3		2	2
CO6	3	2	2	2	1	2		1				2	3		2	2

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191EC62 MACHINE LEARNING

L	T	P	C
3	0	0	3

Programme: B.E. Electronics and Communication Engineering **Sem: 6 Category: PC**

AIM: To understand the new approaches in machine learning to design appropriate algorithms for problem solving

Course Outcomes

CO1: Illustrate the principles and concepts of machine learning. (UN)
CO2: Apply the classification and regression algorithms for different problems. (AP)
CO3: Explain the clustering and dimensionality reduction techniques. (UN)
CO4: Design neural systems for machine learning. (AP)
CO5: Explain reinforcement learning. (UN)
CO6: Demonstrate tools and applications of machine learning. (UN)

INTRODUCTION AND MATHEMATICAL PRELIMINARIES **9**

Introduction and mathematical preliminaries - Vectors - Inner product - Outer product - Inverse of a matrix - Eigen analysis - Singular value decomposition–Random variables - Probability distributions –Marginal and Conditional probability – Chain rule of conditional probability – Common probability distributions–Expectation, variance and covariance - Bayes theorem - Types of Machine Learning algorithms – Supervised and unsupervised learning

CLASSIFICATION AND REGRESSION ALGORITHMS **9**

Linear Classification, Logistic Regression, Naïve Bayes Classifier - Decision trees - Support Vector Machines - KNN model - Ensemble Methods

CLUSTERING AND DIMENSIONALITY REDUCTION **9**

Clustering - K-Means clustering - Hierarchical Clustering - Mixture of Gaussians - Expectation maximization for mixture models (EM) - Dimensionality Reduction - Principal Component Analysis (PCA) - Linear Discriminant Analysis (LDA).

NEURAL NETWORKS **9**

Biological motivation – Neural Networks representation –Perceptron – Feed forward network – Multi layer networks and Back propagation algorithm, Applications of neural networks. Introduction to deep learning

TOOLS AND APPLICATIONS **9**

Linear models for regression - Reinforcement learning – Machine learning tools –Engineering applications

Total Periods 45

TEXT BOOKS

1. E. Alpaydin, “Introduction to Machine Learning”, Second Edition, Prentice-Hall of India, 2010.

REFERENCES

1.Ian Good Fellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016
2. Tom Mitchell, “Machine Learning”, McGraw Hill, 1997.
3. Christopher M.Bishop “Pattern Recognition and Machine Learning”, Springer, 2006
4 Aurelian Geron, “Hands-on Machine Learning with Scikit-Learn, Keras and TensorFlow, Concepts, Tools and Techniques to build intelligent systems”, Oreilly, 2019

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2								1	2		3	
CO2	2	2	2	2	2	1						1	2		3	
CO3	2	2	2	2	2	1						1	2		3	
CO4	3	2	2	2	2							1			3	
CO5	3	2	2	2	2	1						1	2		3	
CO6	2	2	2	2	1							1			3	

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191EC63 DATA COMMUNICATION NETWORKS L-T-P C
3-0-0 3

Programme: B.E. Electronics and Communication Engineering **Sem:** 6 **Category:** PC

AIM: To elaborate the concept, terminologies, and technologies used in modern data communication and computer networking.

Course Outcomes: The students will be able to

CO1: Identify the components required to build different types of networks. (AP)
CO2: Know the functionalities of each layer of the network. (UN)
CO3: Explain the functions of data link layer and standards. (UN)
CO4: Analyze the network layer and various protocols. (AN)
CO5: Compare and classify various internal routing protocols of Transport layer. (AN)
CO6: Explain the application layer services. (UN)

FUNDAMENTAL AND PHYSICAL LAYER **9**

Data Communications – Networks - Networks models – OSI model – Layers in OSI model – TCP / IP protocol suite – Addressing – Guided and Unguided Transmission media, Switching: Circuit switched networks – Data gram Networks – Virtual circuit networks.

DATA LINK LAYER **9**

Data link control: Framing – Flow and error control –Protocols for Noiseless and Noisy Channels – HDLC -Wired LANS : Ethernet – IEEE standards – standard Ethernet – changes in the standard – Fast Ethernet – Gigabit Ethernet– 10 Gigabit Ethernet. Wireless LANS : IEEE 802.11–Bluetooth– WiMAX.

NETWORK LAYER **9**

Logical addressing: IPv4, IPv6 , Internet Protocol: Internetworking – IPv4– ICMPv4 – Next generation IP: IPv6– ICMPv6–LoRaWAN, Delivery - Forwarding – Routing – Unicast, routing protocols-Distance Vector Routing and Link State Routing.

TRANSPORT LAYER **9**

Process-to-Process delivery - User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QoS) – Techniques to improve QoS.

APPLICATION LAYER **9**

Domain Name System (DNS) – E-mail (MIME,SMTP, POP3, IMAP4) – FTP – WWW – HTTP - Digital signature.

Total Periods 45

TEXT BOOK

1. Behrouz A. Foruzan, “Data communication and Networking”, Fifth Edition, Tata McGraw-Hill, 5th edition 2013.

REFERENCES

1. Wayne Tomasi, “Introduction to Data Communication and Networking”, 1/e, Pearson Education.2009
2. James.Kurose.F & Rouse.W, “Computer Networking: A Topdown Approach Featuring”,3/e, Pearson Education.2010
3. Greg Tomshon, Ed Tittel, David Johnson. “Guide to Networking Essentials”, fifth edition, Thomson India Learning, 2007.
4. William Stallings, “Data and Computer Communication”, Eighth Edition, Pearson Education, 2000.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3					2			3	3	2		3
CO2	3	3	2	2								2	3			2
CO3	3	3	3	2	3				2			2	3			2
CO4	3	2	3	3								2	3			2
CO5	3	3	2	3	2	1			3			2	3			2
CO6	3	3	3	3		1						2	3			2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC64	VLSI DESIGN	L-T-P	C
		3-0-2	4

Programme: B.E. Electronics and Communication Engineering **Sem: 6** **Category: PC**

AIM: To elaborate the Concepts of VLSI design using the CMOS technology and CMOS Design.

Course Outcomes: The students will be able to

CO1: Illustrate the working principles of CMOS gates and CMOS fabrication Technology.(UN)
CO2: Analyze the electrical characteristics and electronics analysis of CMOS devices.(AN)
CO3: Design static and dynamic COMS combinational and sequential logic circuits.(AP)
CO4: Construct CMOS arithmetic circuits. (AP)
CO5: Interpret the various FPGA architectures and routing procedures. (UN)
CO6: Examine the various levels of CMOS IC testing. (AP)

MOS TRANSISTOR PRINCIPLE **9**

Introduction, VLSI design Flow, MOSFET as switches, CMOS Logic Gates, Complex logic gates in CMOS ,CMOS Process Technology-Layout design Rules, Stick Diagrams.

ELECTRICAL CHARACTERISTICS AND ELECTRONIC ANALYSIS OF CMOS LOGIC GATES **9**

MOS Device Equation, Non-Ideal Effects, CMOS Inverter DC Transfer Characteristics, Switching Characteristics-Delay Models, Scaling Principles, Power Dissipation, Low Power Design, Interconnect.

STATIC AND DYNAMIC CMOS DESIGN **9**

Static CMOS Design-Bubble Pushing, Compound gates, Asymmetric gates, Skewed Gates, P/N Ratios, Ratioed Logic, Pseudo NMOS logic, Source Follower Pull Up Logic, Cascade voltage Switch logic, Pass Transistors and Transmission gates, Static Sequential circuits.

Dynamic CMOS Design-- Domino logic, Dual Rail Domino Logic, Dynamic Sequential circuits.

DESIGN OF CMOS ARITHMETRIC BUILDING BLOCKS AND IMPLEMENTATION STRATEGIES **9**

Data path system- Adders, Multipliers, Shifters, ALUs, FSM.

FPGA Architectures, Actel Act- Logic Blocks, -Xilinx 3000 logic blocks and I/O Blocks, Interconnect Routing Procedures.

CMOS TESTING **9**

Need for Testing, Manufacturing Test Principles, Chip Level and System Level Test Techniques.

LIST OF EXPERIMENTS: **15**

1.Design and Implementation of
  (a) Ripple carry adder
  (b) Fast Adder
2.Design and implementation of Magnitude comparator.
3. Design and implementation of Flip Flops.
4. Design and implementation of Shift registers.
5. Design and implementation of Up/Down counter.
6. Design and Analysis of CMOS Inverter, NAND& NOR gates using Tanner Tool.
7. Layout design and Analysis of CMOS Inverter, NAND& NOR gates using Microwind Tool.
8. Implementation of CMOS logic Gates in FPGA Kit.
9. Analysis of NMOS and PMOS Transistor Characteristics using Virtual Lab.

Total Periods: 60

TEXT BOOKS

1.Neil H.E Weste&KamaranEshraghian,Principles of CMOS VLSI Design,2nd Edition,Pearson Education,2010

2.John P.Uyemura,Introduction to VLSI Circuits and Systems,John Wiley & Sons Private Ltd,2002

REFERENCES

1.Weste and Harris: CMOS VLSI DESIGN (4th edition) Pearson Education, 2010

2.Pucknell. D.A&K.Eshraghian Basic VLSI Design, Third edition, PHI, 2003

3.Samura Palnitkar –verilog HDL –Guide to digital design and synthesis , 3rd edition , Pearson Education 2003

4.Jan Rabaey.M,Digital Integrated Circuits :A design Perspective, secong Edition fifth reprint Prentice Hall 2002.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	3							2	3	3	1	3
CO2	3	2	2	2	3							2	3	3	1	3
CO3	3	3	3	3	3				3		2	2		3	1	3
CO4	3	3	3	2	3	2			3		2	2		3	1	3
CO5	3	2	1	1	2	2			3		2	2		3	1	3
CO6	3	3	3	3	1	2						2		3	1	3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC67 MACHINE LEARNING LABORATORY L T P C
0 0 2 1

Programme: B.E. Electronics and Communication Engineering **Sem: 6** **Category: PC**

AIM: Enable students to identify the Data sets in implementing the machine learning algorithms

Course Outcomes: The students will be able to

CO1: Construct suitable algorithms for finding the most specific hypothesis based on given training data. (AP)
CO2: Build Artificial Neural Network and test for the given dataset. (AP)
CO3: Make use of Naïve Baye's classifier to classify the given data. (AP)
CO4: Apply clustering algorithms to cluster the given set of data using python or Java. (AP)
CO5: Design regression algorithm to fit the given data points. (AP)
CO6: Apply machine learning algorithms to solve real world problems. (AP)

LIST OF EXPERIMENTS

1. Implement maximum likelihood algorithm
2. Implement Bayes classifier
3. Implement linear regression
4. Design a classifier using perceptron rule
5. Design a classifier using feedforward back-propagation and delta rule algorithms
6. Implement deep learning algorithm
7. Implement linear discriminant algorithm
8. Design a two class classifier using SVM
9. Design a multiclass classifier using SVM
10. Perform unsupervised learning

Total Periods 45

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2					3		1	1	2	2	3	
CO2	2	2	2	2	2	1			3		1	1	2		3	
CO3	2	2	2	2	2	1			3		1	1	2		3	
CO4	3	2	2	2	2			1	3			1			3	
CO5	3	2	2	2	2	1			3			1	2		3	
CO6	2	2	2	2	1			1	3		1	1			3	

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC68 NETWORKS LABORATORY L-T-P C
0-0-2 1

Programme: B.E. Electronics and Communication Engineering **Sem:** 7 **Category:PC**

AIM: To understand the concept, terminologies, and technologies used in modern data communication and computer networking.

Course Outcomes: The students will be able to

CO1: Construct the Parallel communication between PC's.(AP)
CO2: Analyze QOS parameters using Simulation tools. (AN)
CO3: Design of Routing Protocols. (AP)
CO4: Compare the various routing algorithms. (AP)
CO5: Simulate data encryption and Decryption. (AP)
CO6: Develop socket Program. (AP)

LIST OF EXPERIMENTS

1.PC to PC Communication
Parallel Communication using 8 bit parallel cable Serial communication using RS 232C
2. Ethernet LAN protocol
To create scenario and study the performance of CSMA/CD protocol through simulation
3. Token bus and token ring protocols
To create scenario and study the performance of token bus and token ring protocols through simulation
4. Wireless LAN protocols
To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
5. Implementation and study of stop and wait protocol
6. Implementation and study of Go back-N and selective repeat protocols
7. Implementation of distance vector routing algorithm
8. Implementation of Link state routing algorithm
9. Implementation of Data encryption and decryption
10. Transfer of files from PC to PC using Windows / UNIX socket processing.
11.Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS
12.Implementation of Encryption and Decryption algorithms using any programming language

Total Periods: 45

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2				3		1	2	3		3	2
CO2	3	3	2	2	2				3		1	2	3		2	2
CO3	3	3	2	2	2				3		1	2	2	2	2	2
CO4	3	2	2	2	2			1	3			2	2		2	2
CO5	3	2	2	3	2				3			2	2		2	2
CO6	3	2	2	3	2	2		1	3		1	2	3		3	3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC69 **MINI PROJECT** **L-T-P C**
0-0-2 1

Programme: B.E. Electronics and Communication Engineering **Sem 6 Category PROJ**

AIM: To develop a simplified electronic circuits and communication system model suitable for various application.

Course Outcomes:

The students will be able to

CO1: Explain the fundamentals of Electronics and Communication Engineering and allied courses. (UN)

CO2: Identify the societal need based problems either from rigorous literature survey or from the requirements raised from need analysis.(AP)

CO3: Interpret the key stages in development of the project.(UN)

CO4: Analyze the key ideas in project.(AN)

CO5: Develop the prototype using modern tools and hardware.(AP)

CO6: Paraphrase comprehensive report and presentable about the project work. (UN)

Total Periods 30

Syllabus Contents:

The students are required to search / gather the material / information on a specific a topic Comprehend it and present / discuss in the class. They can take up small problems in the field of design engineering as mini project. It can be related to solution to an engineering problem, verification and analysis of experimental data available, conducting experiments on various engineering subjects, material characterization, studying a software tool for the solution of an engineering problem

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	3	2	1	1	3	2	2	2	3	3	3	3
CO2	3	3	3	3	2	3	1	1	3	2	2	2	3	3	3	3
CO3	3	2	2	2	2	2	1	1	3	3	3	2	2	2	2	2
CO4	3	2	2	2	2	2	1	1	3	3	3	2	2	2	2	2
CO5	3	3	2	2	2	2	1	1	3	2	3	2	3	3	3	3
CO6	3	3	2	2	2	2	1	1	3	2	3	2	3	2	2	3

Entercorrelationlevels1,2or3asdefinedbelow:1:Slight(Low)2:Moderate(Medium)3:Substantial(High)

191EC71 ROBOTICS AND ARTIFICIAL INTELLIGENCE L T P C
3 0 0 3

Programme: B.E. Electronics and Communication Engineering **Sem: 7 Category: PC**
AIM: To design the robotic systems using artificial intelligence concepts.
Course Outcomes

CO1: Classify the different types of Robots. (UN)
CO2: Illustrate the concept of intelligent agents. (UN)
CO3: Apply AI methods to solve various problems. (AP)
CO4: Develop knowledge base sentences using propositional logic and first order logic. (AP)
CO5: Apply the State-Space Search problem-solving paradigm for Game playing. (AP)
CO6: Explain the different planning strategies of AI. (UN)

INTRODUCTION
Types of Robot–Technology-Robot classifications and specifications-Degree of freedom and degree of motion-Manipulation of various components-sensors, Need for AI in Robotics, Thinking and acting humanly, Intelligent agents, structure of agents.

PROBLEM SOLVING
Production System, State-Space Search, Control Strategies, Characteristics of problem, Uninformed Search Techniques, Heuristic search Techniques, Constraint Satisfaction.

PROBLEM REDUCTION AND GAME PLAYING
Problem Reduction - Game Playing - Bounded Look-Ahead Strategy - Alpha-Beta Pruning -Two-Player Perfect Information Games.

LOGIC CONCEPTS AND LOGIC PROGRAMMING
Propositional Calculus, Propositional Logic, Natural Deduction System, Semantic Tableau System, Resolution Refutation, Predicate Logic, Logic Programming.

PLANNING
Types of planning systems, Block World Problem, Logic-Based Planning, Linear Planning Using a Goal Stack, Means-Ends Analysis, Non-Linear Planning Strategies

TOTAL PERIODS45

TEXT BOOKS
1. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning, 2011
2. Stuart Russell, Peter Norvig, “Artificial Intelligence: A modern approach”, 3rd Edition, Pearson Education, India, 2011.
3. Appuu Kuttan K.K, “Robotics”, I.K. International Publishing House Pvt. Ltd., 2007.

REFERENCES
4. David Jefferis, “Artificial Intelligence: Robotics and Machine Evolution”, Crabtree Publishing Company, 1999.
5. Elaine Rich, Kevin Knight, “Artificial Intelligence”, 3rd Edition, Tata McGraw Hill, 2019.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1						1		1				1		2
CO2	2	1														2
CO3	3	2	1		1				1							2
CO4	3	2	1													2
CO5	3	2	1		1				1							2
CO6	2	1														2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC72	DIGITAL IMAGE PROCESSING	L-T-P	C
		3-0-0	3

Programme: B.E. Electronics and Communication Engineering **Sem:** 7 **Category:** PC

AIM: To analyze digital image fundamentals and familiar with image compression and segmentation techniques

Course Outcomes: The Students will be able to

CO1: Explain the digital image fundamentals. (UN)
CO2: Interpret the image enhancement techniques. (UN)
CO3: Illustrate the image restoration model. (UN)
CO4: Explain the methods of image segmentation techniques. (UN)
CO5: Illustrate wavelets and image compression techniques. (UN)
CO6: Explain the image representation and recognition techniques. (UN)

DIGITAL IMAGE FUNDAMENTALS **9**

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals -RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

IMAGE ENHANCEMENT **9**

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – **Frequency Domain:** Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

IMAGE RESTORATION AND SEGMENTATION **9**

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation-Morphological processing- erosion and dilation - Segmentation by morphological watersheds.

WAVELETS AND IMAGE COMPRESSION **9**

Wavelets – Subband coding - Multiresolution expansions - Compression: Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.

IMAGE REPRESENTATION AND RECOGNITION **9**

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TOTAL PERIODS 45

TEXT BOOKS

1.Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2018.
2.Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.

REFERENCES

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2. Willliam K Pratt, "Digital Image Processing", John Willey, 2002.
3. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI LearningPvt. Ltd., 2011.
4. http://eeweb.poly.edu/~onur/lectures/lectures.html.
5. http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2								1			3	
CO2	2	2	2	2	2	1						1			3	
CO3	2	2	2	2	2	1						1			3	
CO4	3	2	2	2	2							1			3	
CO5	3	2	2	2	2	1						1			3	
CO6	2	2	2	2	1							1			3	

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC73 FIBER OPTIC COMMUNICATIONAND NETWORKS L-T-P C
3-0-2 4

Programme: B.E. Electronics and Communication Engineering **Sem 7 Category: PC**

AIM: To analyze and design the various optical fiber concepts and its associated parameters on system performance.

Course Outcomes: The students will be able to
CO1: Explain the basic elements of optical fiber communication. (UN)
CO2: Compare the fiber optic sources. (UN)
CO3: Explain the concept of photodetectors. (UN)
CO4: Illustrate fiber power Launching and coupling. (UN)
CO5: Analyze the performance of optical receiver. (AN)
CO6: Explain the operational principle of WDM. (UN)

INTRODUCTION TO OPTICAL FIBERS **9**

Overview of Optical Fiber Communication : Evolution of Fiber Optic Systems-Elements of an Optical Fiber Transmission Link – Basic Optical Laws and Definitions - Optical Fiber Modes and Configurations- Mode Theory for Circular Waveguides - System performance .Mode Single Mode Fibers - Graded Index fiber structure - Losses in optical fibers-Attenuation & Dispersion.

9

FIBER OPTICAL SOURCES & PHOTO DETECTORS

Light Emitting Diodes - Laser Diodes - Comparison and Applications - Physical principles of Photodiodes, Photo detector Noise, Detector Response Time - Avalanche Multiplication Noise - Comparisons of Photo detectors.

POWER LAUNCHING AND COUPLING **9**

Source to Fiber Power Launching- Lensing Schemes for Coupling Improvement – Fiber to Fiber Joints-LED Coupling to Single Mode Fibers-Fiber Splicing-Optical Fiber Connectors

DIGITAL TRANSMISSION SYSTEMS & OPTICAL RECEIVERS **9**

Point to Point links - Noise effect on System Performance – Fundamental Receiver Operations – Digital Receiver Performance –Detailed Performance Calculations- Pre amplifier Types - Analog receiver

WDM CONCEPTS AND OPTICAL NETWORKS **9**

Operational Principles of WDM – SONET/SDH Transmission Formats and Speeds- Optical Interfaces-SONET/SDH Rings- SONET/SDH Networks-Broadcast and Select WDM Networks -Wavelength Routed Networks - Nonlinear Effects on Network Performance- Solitons - Optical CDMA-Ultrahigh Capacity Networks

LIST OF EXPERIMENTS:

1. Measurement of connector, bending and fiber attenuation losses.
2. Numerical Aperture and Mode Characteristics of Fibers.
3. DC Characteristics of LED and PIN Photo diode.
4. Fiber optic Analog and Digital Link Characterization - frequency response(analog), eye diagram and BER (digital)

TOTAL PERIODS 60

TEXT BOOK

1.Gerd Keiser "Optical Fiber Communications", McGraw Hill, New Delhi, 3rd edition, 2008.

REFERENCES

1. Franz J.H. Jain V.K, "Optical Communication, Components and systems", Narosa publications, New Delhi, 2000.
2. Mynbaev.K and Lowell L Scheiner, "Fiber Optic Communication Technology", Pearson Education Asia, New Delhi, 2001.
3. Gower, J "Optical Communication Systems", PHI, New Delhi, 2nd edition, Fifth reprint,1995.
4. John M. Senior,"Optical Fiber Communication" Pearson Education – Second Edition. 2007

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	2				3			1	3			
CO2	3	2	3	2	2	1			3			1	3			
CO3	3	3	2	2	2	1			3			1	2			
CO4	3	2	2	2	2	1			3			2	2			
CO5	3	3	2	3	2	1			3			1	2	2	2	
CO6	3	3	3	2	2	2			3			2	2			

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC77 **ROBOTICS AND ARTIFICIAL INTELLIGENCE LABORATORY**

L	T	P	C
0	0	2	1

Programme: B.E. Electronics and Communication Engineering **Sem: 7** **Category: PC**

AIM: To develop robotics systems using AI

Course Outcomes

Students will be able to

CO1: Develop bluetooth controlled and voice controlled RSLK.(AP)
CO2: Control RSLK through blynk application. (AP)
CO3: Design free roaming RSLK with the use of sensors.(AP)
CO4: Develop pick and place robot. (AP)
CO5: Build robot for color and shape identification.(AP)
CO6: Develop robot for industrial process. (AP)

1. Study of Engergia Software
2. Simple forward and backward navigation of Robotic System Learning Kit (RSLK)
3. Bluetooth Controlled RSLK
4. Voice Controlled RSLK
5. Free roaming decision making RSLK
6. Controlling and Monitoring RSLK Through Blynk Cloud
7. Simulation and Robot Programming for pick and place
8. Simulation and Robot Programming for color identification
9. Simulation and Robot Programming for shape identification
10. Simulation and Robot Programming for any industrial process

TOTAL PERIODS45

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	3	2			3	1	2	2	1	2	2	3
CO2	3	2	2	1	3	2			3	2	2	2	1	2		3
CO3	3	2	2	1	3	2		1	3	1	2	2		2		3
CO4	3	2	2	1	3	2			3	1	2	2		2		3
CO5	2	2	2	1	3	2			3	2	2	2		2	2	3
CO6	2	2	2	1	3	2		1	3	1	2	2		2		3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC78 DIGITAL IMAGE PROCESSING LABORATORY L T P C
0 0 2 1

Programme: B.E. Electronics and Communication Engineering **Sem: 7** **Category: PC**

AIM: To analyze and estimate the various image processing methods

Course Outcomes

CO1: Analyze the enhancing operations on the image using spatial filters and frequency domain filters.(AN)
CO2: Apply transforms and analyze the characteristics of the image(AP)
CO3: Illustrate segmentation operations in the images.(UN)
CO4: Explain the efficiency of the compression technique on the images.(UN)
CO5: Simulate Image compression and Image restoration techniques.(AP)
CO6: Interpret the DICOM standards. (UN)

LIST OF EXPERIMENTS
Simulation using MATLAB
1.Image sampling and quantization
2.Analysis of spatial and intensity resolution of images.
3.Intensity transformation of images.
4.DFT analysis of images
5.Transforms (Walsh, Hadamard, DCT, Haar)
6.Histogram Processing and Basic Thresholding functions
7.Image Enhancement-Spatial filtering
8.Image Enhancement-Filtering in frequency domain
9.Image segmentation–Edge detection, line detection and point detection.
10.Basic Morphological operations and Segmentation using watershed transformation
11.Region based Segmentation
12.Analysis of images with different color models.
13.Study of DICOM standards
14.Image compression and Image restoration techniques

TOTAL PERIODS 45

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2					3	1	1	1	2	2	3	
CO2	2	2	2	2	2	1			3	1	1	1	2		3	
CO3	2	2	2	2	2	1			3	1	1	1	2		3	
CO4	3	2	2	2	2				3	1	1	1			3	
CO5	3	2	2	2	2	1			3	1	1	1	2		3	
CO6	2	2	2	2	1				3	1	1	1			3	

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC79 **PROJECT – I**

L	T	P	C
0	0	4	2

Programme: B.E. Computer Science and Engineering **Sem 7 Category PROJ**

Aim: To develop student's knowledge for solving technical problems through structured project research study in order to produce competent and sound engineers.

Course Outcomes: The Students will be able to

CO1: Explain the fundamentals of Electronics and Communication Engineering and allied courses. (UN)

CO2: Identify the societal need based problems either from rigorous literature survey or from the requirements raised from need analysis.(AP)

CO3: Interpret the key stages in development of the project.(UN)

CO4: Analyze the key ideas in the project.(AN)

CO5: Develop the prototype using modern tools and hardware.(AP)

CO6: Paraphrase comprehensive report and presentable about the project work. (UN)

Syllabus content:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the vital need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following

- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Problems of national importance
- Research and development in various domain

The student should complete the following:

- Motivation for study and objectives
- Literature survey problem definition
- Preliminary design / feasibility / modular approaches
- Implementation and validation
- Presentation and Report preparation.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	3	2	1	1	3	2	2	2	3	3	3	3
CO2	3	3	3	3	2	3	1	1	3	2	2	2	3	3	3	3
CO3	3	2	2	2	2	2	1	1	3	3	3	2	2	2	2	2
CO4	3	2	2	2	2	2	1	1	3	3	3	2	2	2	2	2
CO5	3	3	2	2	2	2	1	1	3	2	3	2	3	3	3	3
CO6	3	3	2	2	2	2	1	1	3	2	3	2	3	2	2	3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191EC89 **PROJECT– II**

L	T	P	C
0	0	12	6

Programme: **B.E Electronics and Communication Engineering** **Sem 8** **Category: PROJ**

Aim: To develop students knowledge for solving technical problems through structured project research study in order to produce competent and sound engineers.

CO1: Explain the fundamentals of Electronics and Communication Engineering and allied courses. (UN)
CO2: Identify the problem statement to satisfy the needs of industry, research and society.(AP)
CO3: Interpret the key stages in development of the project.(UN)
CO4: Analyze the key ideas in mini project.(AN)
CO5: Develop the prototype using modern tools and hardware.(AP)
CO6: Paraphrase comprehensive report and presentable about the project work. (UN)

Syllabus Contents:

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

- Design, fabrication and analyzing of proposed research work.
- Experimental verification / Proof of concept.
- The viva-voce examination will be based on the above report and work

Course Outcomes	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	3	2	1	1	3	2	2	2	3	3	3	3
CO2	3	3	3	3	2	3	1	1	3	2	2	2	3	3	3	3
CO3	3	2	2	2	2	2	1	1	3	3	3	2	2	2	2	2
CO4	3	2	2	2	2	2	1	1	3	3	3	2	2	2	2	2
CO5	3	3	2	2	2	2	1	1	3	2	3	2	3	3	3	3
CO6	3	3	2	2	2	2	1	1	3	2	3	2	3	2	2	3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

PROGRAMME ELECTIVES

191ECEA CMOS ANALOG IC DESIGN L-T-P C
3-0-0 3

Programme: B.E. Electronics and Communication Engineering **Sem:-** **Category:**PE
Aim: To design and implement Analog ICs using CMOS techniques

Course Outcomes: The students will be able to
CO1: Develop the various current mirror circuits (AP)
CO2: Categorize the CMOS amplifier configurations (AN)
CO3: Interpret the feedback circuit in CMOS Analog design (UN)
CO4: Analyze the frequency response and noise for CMOS amplifier (AN)
CO5: Analyze stability and frequency compensation techniques for CMOS Operational Amplifiers (AN)
CO6: Construct switched Capacitor circuits and PLL (AP)

INTRODUCTION TO ANALOG IC DESIGN AND CURRENT MIRRORS 9

Concepts of Analog Design - General consideration of MOS devices – MOS I/V Characteristics – Second order effects – MOS device models. Basic current mirrors- Cascode current mirrors- Active current mirrors- Large and Small signal analysis- Common mode properties.

AMPLIFIERS AND FEEDBACK 9

Basic Concepts – Common source stage- Source follower- Common gate stage- Cascode stage. Single ended and differential operation- Basic Differential pair- Common mode response- Differential pair with MOS loads- Gilbert Cell. Feedback- General Consideration of feedback circuits- Feedback topologies- Effect of loading- Effect of feedback on Noise.

FREQUENCY RESPONSE OF AMPLIFIERS AND NOISE 9

General considerations- Miller Effect and Association of Poles with Nodes, Common source stage- Source followers- Common gate stage- Cascode stage- Differential pair. Noise- Statistical characteristics of noise- Types of noise- Representation of noise in circuits- Noise in single stage amplifiers- Noise in differential pairs- Noise Bandwidth.

OPERATIONAL AMPLIFIER STABILITY AND FREQUENCY COMPENSATION 9

General Considerations- One and Two Stage Op Amps- Gain Boosting- Comparison- Common mode feedback- Input range limitations- Slew rate- Power Supply Rejection- Noise in Op Amps- General consideration of stability and frequency compensation- Multipole system- Phase margin- Frequency compensation- Compensation of two stage op Amps- Other compensation techniques.

SWITCHED CAPACITOR CIRCUITS AND PLLS 9

General Considerations- Sampling switches- Switched Capacitor Amplifiers- Switched Capacitor Integrator- Switched Capacitor Common mode feedback. Phase Locked Loops-Simple PLL- Charge pump PLLs - Non ideal Effects in PLLs- Delay locked loops- its Applications.

Total Periods: 45

Text Book

1. Behzad Razavi, ―Design of Analog CMOS Integrated Circuits‖, Tata McGraw Hill, 2001, 33rd reprint, 2016.

References

1. Phillip Allen and Douglas Holmberg ―CMOS Analog Circuit Design‖ Second Edition, Oxford University Press, 2004.
2. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design of

Analog Integrated Circuits, 5th Edition, Wiley, 2009
3. Grebene, ―Bipolar and MOS Analog Integrated circuit design‖, John Wiley & sons, Inc., 2003

Course Outcomes	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	1	1						2	3	3		2
CO2	3	3	3	2	2						2	2	3	3		2
CO3	3	3	3	3	3				3		2	2		3	3	3
CO4	3	3	3	3	3	2			3		2	2		3		3
CO5	3	3	3	2	2							2		3		3
CO6	3	3	3	3	3							2		3		3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEB COGNITIVE RADIO L-T-P C

3-0-0 3

Programme: B.E. Electronics and Communication Engineering **Sem:-** **Category:** PE

AIM: To know the basics of the software defined radios and understand the concepts of wireless networks and next generation wireless networks.

Course Outcomes: The students will be able to

CO1: Explain the basics of the software defined radios.(UN)
CO2: Illustrate software defined radio architecture. (UN)
CO3: Explain the basics of cognitive radios. (UN)
CO4: Build the architecture of cognitive radio. (AP)
CO5: Interpret about cognition cycle. (UN)
CO6: Analyze the next generation wireless networks. (AN)

INTRODUCTION TO SOFTWARE DEFINED RADIO **9**

Definitions and potential benefits, software radio architecture evolution, technology tradeoffs andarchitecture implications.

SDR ARCHITECTURE **9**

Essential functions of the software radio, basic SDR, hardware architecture, Computational processing resources, software architecture, top level component interfaces, interface topologies among plug and play modules.

INTRODUCTION TO COGNITIVE RADIOS **9**

Marking radio self-aware, cognitive techniques – position awareness, environment awareness incognitive radios, optimization of radio resources, Artificial Intelligence Techniques.

COGNITIVE RADIO ARCHITECTURE **9**

Cognitive Radio - functions, components and design rules, Cognition cycle - orient, plan, decide and act phases, Inference Hierarchy, Architecture maps, Building the Cognitive Radio Architecture on Software defined Radio Architecture.

NEXT GENERATION WIRELESS NETWORKS **9**

The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrumsharing, upper layer issues, cross – layer design.

Total Periods: 45

Text Books

1. Joseph Mitola,"Software Radio Architecture: Object-Oriented Approaches to Wireless SystemEngineering", John Wiley & Sons Ltd. 2000.
2. Thomas W.Rondeau, Charles W. Bostain, "Artificial Intelligence in Wireless communication",Artech House .2009.

References

1. Simon Haykin, "Cognitive Radio: Brain –Empowered Wireless Communications", IEEE Journal on selected areas in communications, Feb 2005.
2. Hasari Celebi, Huseyin Arslan, "Enabling Location and Environment Awareness in CognitiveRadios", Elsevier Computer Communications, Jan 2008.
3. Markus Dillinger, Kambiz Madani, Nancy Alonistioti, "Software Defined Radio", John Wiley, 2003.
4. Huseyin Arslan, "Cognitive Radio, SDR and Adaptive System", Springer, 2007.
5.Alexander M. Wyglinski, Maziarnekovee, Thomas Hu Y., "Cognitive Radio Communication and Networks", Elsevier, 2010.
6. Bruce A. Fette, "Cognitive Radio Technology", Elsevier, 2009.
7. Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, "Next generation / dynamic spectrum access / cognitive radio wireless networks: A Survey" Elsevier Computer Networks ,May 2006

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	1							2	3	1	3	2
CO2	3	3	2	2	2	1						2	3	1	3	2
CO3	3	3	2	2	2	1	1					2	3	1	3	2
CO4	3	3	2	2	2	2						2	3	1	3	2
CO5	3	3	2	2	2	2	2					2	3	1	3	2
CO6	3	3	2	2	2	2	2					2	3	1	3	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEC CRYPTOGRAPHY AND NETWORK SECURITY L-T-P C
3-0-0 3

Programme: B.E. Electronics and Communication Engineering **Sem:-** **Category:** PE

AIM: To implement the principles of public key cryptosystems, hash functions and digital signature.

Course Outcomes: The students will be able to

CO1: Explain the concepts of network security model.(UN)
CO2: Interpret concepts of mathematical preliminaries of networking.(UN)
CO3: Illustrate various encryption algorithms for crypto systems.(UN)
CO4: Explain authentication requirements for crypto systems.(UN)
CO5: Classify the types of firewalls. (UN)
CO6: Explain various services for network security. (UN)

INTRODUCTION AND NUMBER THEORY 9

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography). Finite fields and number theory: Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem-Testing for primality –The Chinese remainder theorem-Discrete logarithms.

BLOCK CIPHERS AND PUBLIC KEY CRYPTOGRAPHY 9

Data Encryption Standard-Block cipher principles-block cipher modes of operation -Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm -Key management – Diffie Hellman Key exchange -Elliptic curve arithmetic- Elliptic curve cryptography.

HASH FUNCTIONS AND DIGITAL SIGNATURES 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 – SHA – HMAC – CMAC – Digital signature and authentication protocols –DSS – EI Gamal – Schnorr.

SECURITY PRACTICE AND SYSTEM SECURITY 9

Authentication applications – Kerberos – X.509 Authentication services – Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls – Firewall designs – SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

E-MAIL, IP & WEB SECURITY 9

E-mail Security: Security Services for E-mail-attacks possible through E-mail – establishing keysprivacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSec – IP and Ipv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol-computing the keys-client authentication-PKI as deployed by SSLAttacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET).

Total Periods: 45

Text Book

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013.

References

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007.
2. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.

3. Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall of India, 2006.
4. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.
5. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002.

Course Outcomes	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1								3	3			3
CO2	3	3	3	2	2							2	3			2
CO3	3	3	3	2	3				2			2	3		2	2
CO4	3	2	3	3	2	2			2			2	3		3	2
CO5	3	3	2	3	2				2			2	3			2
CO6	3	3	2	3	2	2		2	2		2	2	3		2	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECED **CYBER SECURITY** **L-T-P C**
3-0-0 3

Programme: B.E. Electronics and Communication Engineering **Sem:-** **Category:**PE

Aim: To understand issues associated with the nature of cybercrime, digital evidence, detection methods and proof in a variety of digital forensic contexts

Course Outcomes: The students will be able to

CO1: Explain the concepts of cybercrime. (UN)
CO2: Interpret the various issues of cybercrime. (AN)
CO3: Summarize the tools of cybercrime investigation. (UN)
CO4: Examine the Encryption and Decryption Methods. (AN)
CO5: Develop the procedures of digital forensics. (AP)
CO6: Identify various laws and acts in Cyber security. (AP)

INTRODUCTION **9**

Introduction and overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime.

CYBER CRIME ISSUES **9**

Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.

INVESTIGATION **9**

Introduction to Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

DIGITAL FORENSICS **9**

Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics.

LAWS AND ACTS **9**

Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies.

Total periods: 45

Text Book

1. Nelson Phillips and Enfinger Steuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2009.

References

1. Kevin Mandia, Chris Prosise, Matt Pepe, “Incident Response and Computer Forensics “, Tata McGraw –Hill, New Delhi, 2006.
2. Robert M Slade,” Software Forensics”, Tata McGraw – Hill, New Delhi, 2005.
3. Bernadette H Schell, Clemens Martin, “Cybercrime”, ABC – CLIO Inc, California,

2004."Understanding Forensics in IT", NIIT Ltd, 2005.

Course Outcomes	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	2	1		2			2	2	2			1
CO2	3	2	2	2	2	1	2	2			2	2	2			1
CO3	3	2	2	2	2	2		2			2	2	3		3	2
CO4	3	2	2	2	2	2		2			2	2	3		3	2
CO5	3	2	2	2	2	2		2			2	2	3		3	2
CO6	3	2	2	2	2	2		2			2	2	2			1

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEE EDGE COMPUTING L-T-P C

3-0-0 3

Programme: B.E. Electronics and Communication Engineering **Sem:** 6 **Category:** PE

Aim: To elaborate the concept, terminologies, and technologies used in edge computing.

Course Outcomes: The students will be able to

CO1: Explain the basics of edge computing. (CR)
CO2: Apply edge computing for Industry Intelligence. (AP)
CO3: Interpret the architecture and development of edge computing.(UN)
CO4: Identify the business practices of edge computing. (AP)
CO5: Illustrate the Edge Development process.(UN)
CO6: Examine debugging of edge moduless. (AN)

INTRODUCTION TO EDGE COMPUTING **9**

Concepts of Edge computing-Basic Characteristics and Attribute, "CROSS" Value of Edge Computing, Collaboration of Edge Computing and Cloud Computing

EMBRACING THE INDUSTRY INTELLIGENCE ERA **9**

Data link control: Framing – Flow and error control –Protocols for Noiseless and Noisy Channels – The Industry Intelligence Era-Challenges to Industry Intelligence 2.0,Edge Computing Enables Industry Intelligence 2.0,Current Progress of Industrialization of Edge Computing.

REFERENCE ARCHITECTURE OF EDGE COMPUTING **9**

Model-Driven Reference Architecture,Multi-View Display,Concept View- ECNs, Development Frameworks, and Product Implementation- Edge Computing Domain Model, Function View –ECN-Service Fabric- CCF-Development Service Framework-Deployment Operation Service Framework-Management Service- Full-Lifecycle Data Service-Security Service, Deployment View

ECC INDUSTRY DEVELOPMENT AND BUSINESS PRACTICE **9**

ECC Industry Development Overview - Cooperation Between the ECC and Industry Organizations-Cooperation Between the ECC and Standardization Organizations, Business Practices of Edge Computing-Theory and Practice of Edge Computing- Implementation of Horizontal Solutions in Vertical Industries-Requirements and Practices of Edge Computing.

DEVELOPING AND DEBUGGING EDGE MODULES **9**

Edge Development Process, Azure IoT Edge Hub Dev Tool- Solution Mode- Single Module Mode, Azure IoT Edge Dev Tool- Getting Started with the IoT Edge Dev Tool- IoT Edge Dev Tool Initial Commands-Using the IoT Edge Dev Tool, Debugging Edge Solutions- VS Code Debugging Overview - VS Code Debugging in Solution Mode- VS Code Debugging in Single Module Mode- Visual Studio Debugging, Third Party Edge Module- Modbus Edge Module- OPC UA Edge Module.

Total Periods: 45

Text Book

1. David Jensen," Beginning Azure IoT Edge Computing Extending the Cloud to the Intelligent Edge", Powder Springs, GA, USA,2019

References

1. Lawrence Miller,"Edge Computing" Stratus Special Edition, CISSP,2020
2. Rajkumar Buyya, Satish Narayana Srirama,"Fog and Edge Computing: Principles and Paradigms,2019

Course Outcomes	Program Outcomes (POs)	Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3					2			3	3	2		3
CO2	3	3	2	2								2	3			2
CO3	3	3	3	2	3				2			2	3			2
CO4	3	2	3	3								2	3			2
CO5	3	3	2	3	2	1			3			2	3			2
CO6	3	3	3	3		1						2	3			2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEF ELECTROMAGNETIC COMPATIBILITY L-T-P C
3-0-0 3

Programme: B.E. – Electronics and Communication Engineering **Sem:-** **Category:** PE

AIM: To lay good foundation on electromagnetic interference, control and compatibility in system design.

Course Outcomes:

The Students will be able to

CO1: Classify the different EMC standards (UN)
CO2: Explain the various emission measurements of EMI.(AN)
CO3: Examine the different testing methods. .(AN)
CO4: Build the different types of filters (AP)
CO5: Explain the shielding mechanisms. (UN)
CO6: Develop PCB design for Electromagnetic compatibility (AP)

EMI/EMC CONCEPTS AND STANDARDS 9

Introduction and history of EMI, problems and effects of EMI, need for EMC, realization of EMC, EMC tests and measurement, elements of EMI , coupling mechanisms , EMI victims, types of EMC standards, civilian EMC standards, military EMC standards, introduction to EMC testing

EMISSION MEASUREMENTS 9

Basic and laboratory test setup, measurement instrumentation, EMI receiver, units of measurement, conducted emission limits, EUT configuration, discontinuous emission or clicks, measurement of clicks, low frequency conducted emissions, frequency range of measurement , limits, measurement site, disturbance power measurement , near field emission measurement , test reports

IMMUNITY AND SUSCEPTIBILITY TESTING 9

General test setup, electrical fast transients / burst (EFT/B),surge testing, conducted susceptibility – continuous wave (CW), electrostatic discharge test

Shileded enclosures, antennas and radiating systems, signal generators and amplifiers, measuring equipment ,ancillary equipment, severity levels and frequency ranges, rf electromagnetic field immunity test, magnetic field immunity test, evaluation of test results and test reports

FILTERING AND SHIELDING 9

Basic elements of filters and filter components, filter types, filter impedance, power line filter design, multistage power line filters, transient suppression in relays and motors, ferrite beads, filters for dc lines,filter installation, filter performance evaluation

Mechanism of radiation, shielding mechanisms, choice of shield material, shielding and equipment enclosures, penetrations and apertures, leakages at seams, shielding for connector openings, shielding of plastic enclosures, shields for cables

PCB DESIGN FOR EMC 9

Need for EMC design at PCB level, printed circuit board (PCB), board zoning, aspects of a good PCB design, common impedance coupling in PCBs, general considerations for a PCB, multilayer board and high speed PCB design, power and ground planes , plane and cavity resonance, cavity resonance between planes, fringing fields and their reduction, openings and discontinuities in ground plane, optimising anti-pad design, routing traces close to antipads, issues with a split plane, traces crossing and changing layers, connection of devices to planes ,placement of decoupling capacitors, advantages of multiple decaps, position of devices, layer stacking in boards, high density interconnect (HDI) technology, board segregation

Total Periods 45

Text Book

1. ChetanKathalay, “A Practical Approach to Electromagnetic Compatibility”, 1st Edition, EMC

Publications, 2014.

References

1. Bemhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Ed, Artech house, Norwood, 1998.
2. C.R.Paul,"Introduction to Electromagnetic Compatibility", John Wiley and Sons, 2nd Edition, 2006.
3. Don R. J.White Consultant Incorporate, "Handbook of EMI/EMC", Vol I-V, 1988.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2		1						2	3	3		3
CO2	2	3	3		2	1							2	2		1
CO3	2	2	2		1								2	3		
CO4	2	3	3		1								3	2		
CO5	2	3	3		2								2	1		
CO6	2	3	3		1	1							2	1		2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEG ELECTRONIC PRODUCT DESIGN L-T-P C

3-0-0 3

Programme: B.E. Electronics and Communication Engineering **Sem:-** **Category:** PE
AIM: To acquire knowledge in PCB design, fabrication and EMI reduction techniques

Course Outcomes: The students will be able to
CO1: Explain design and manufacturing process. (UN)
CO2: Analyze PCB design rules for various electronic circuits.(AN)
CO3: Make use of EMI reduction techniques.(AP)
CO4: Demonstrate electronic systems packaging.(UN)
CO5: Compare various approaches in electronic product design.(UN)
CO6: Identify the issues in electronic product design.(AP)

MANUFACTURING PROCESS AND INTERCONNECTION TECHNIQUES 9

Design Overview, Design Process, Product Design Methodology, Anatomy of Design Process and Translation of product concepts to manufacturing process, Elements of Interconnection, Wires, Cables, Connectors, Termination Methods. Maintainability and Serviceability Considerations, Electrical, Mechanical and other Aspects.

PCB DESIGN AND FABRICATION 9

Overview of PCB Design, Guidelines, General Considerations for PCB Layout, Artwork, Photo Printing, Screen Printing, Plating, Etching, Soldering and Assembly Techniques, Emerging PCB Technology Trends, Overview of Design rules for Analog circuit PCB, Digital circuit PCB, Power circuit PCB, Application of Heat Sink concepts.

ELECTRO MAGNETIC INTERFERENCE (EMI) REDUCTION TECHNIQUES 9

Occurrence of EMI, Electromagnetic Compatibility (EMC), Safety Ground, Grounding Schemes, Differences between Analog and Digital Ground, Shielding Techniques, Line Impedance Stabilization, Network (LISN), Conducted Noises,Common Mode Noises (CM), Differential Mode Noises (DM), EMI filter Design.

OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING

System and history of semiconductors, Products and levels of packaging, handheld products, PWB, Semiconductor and Process flowchart, Wafer fabrication, Wafer packaging; Inspection and testing, Packaging evolution; Chip connection choices, Wire bonding, TAB and flip chip.

ELECTRONIC PRODUCT DESIGN 9

Overview of Electronic Product Design, Top-Down and Bottom-Up Approach, Considering Power Supply Design as an example, Ergonomic and Aesthetics Definition with Example, issues in Designing Electronic Products, Design of Controls and Display.

Total Periods 45

Text Books

1. Walter C Bosschard, “PCB design & Technology”, McGraw Hill, New Delhi.
2. Ronald A. Reis, “Electronic Project Design and Fabrication”, Prentice Hall.

References

1.Harper, “Handbook of Electronic Packaging”, Mc Graw Hill, New York 1979.
2.R. S. Khandpur, “Printed Circuit Boards: Design, Fabrication, Assembly and Testing”, Tata Mc Graw Hill Book Co
3.Tim Williams, EMC for Product Designers, 4th ed.-Newnes.
4.V.S.Bagad, “Electronic Product Design”, Technical Publications.

Course Outcomes	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2							2	3	3		2
CO2	2	3	2	2	2							2	3	3		2
CO3	2	2	2	2	2	1	2					2	2	3	3	2
CO4	3	2	3	3	2							2	2	3		2
CO5	3	3	2	2	2		2					2	3	3		2
CO6	3	3	2	2	2	1	1					2	2	3		2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEH LOW POWER SOC DESIGN L-T-PC
3-0-0 3

Programme: B.E. Electronics and Communication Engineering **Sem:-** **Category:**PE

Aim: To analyze and design low-power VLSI circuits using various circuit technologies for system on chip design

Course Outcomes: The students will be able to

CO1: Develop low power techniques to design CMOS circuits. (AP)
CO2: Illustrate the concepts of SOC design. (UN)
CO3: Analyze the optimization techniques for SOC design. (AN)
CO4: Explain SOC design concepts in digital system design. (UN)
CO5: Develop the low power techniques for SOC subsystem design. (AP)
CO6: Classify Back end design algorithms for low power CMOS circuits. (AN)

POWER CONSUMPTION IN CMOS **9**

Physics of power dissipation in CMOS FET devices – Hierarchy of limits of power – Sources of power consumption – Static Power Dissipation, Active Power Dissipation - Designing for Low Power, Circuit Techniques for Leakage Power Reduction - Basic principle of low power design, Logic level power optimization – Circuit level low power design.

SYSTEM-ON-CHIP DESIGN **9**

System-on-Chip Concept, Design Principles in SoC Architecture, SoC Design Flow, Platform-based and IP based SoC Designs, Basic Concepts of Bus-Based Communication Architectures. High performance algorithms for ASICs/ SoCs as case studies – Canonic Signed Digit Arithmetic, KCM, Distributed Arithmetic, High performance digital filters for sigma-delta ADC.

POWER OPTIMIZATION OF COMBINATIONAL AND SEQUENTIAL LOGIC MACHINES FOR SOC **9**

Introduction to Standard Cell-Based Layout – Simulation - Combinational Network Delay - Logic and interconnect Design - Power Optimization - Switch Logic Networks. Introduction - Latches and Flip-Flops - Sequential Systems and Clocking Disciplines - Sequential System Design - Power Optimization - Design Validation - Sequential Testing.

DESIGN OF LOW POWER CIRCUITS FOR SUB SYSTEM ON A SOC **9**

Subsystem Design Principles - Combinational Shifters – Adders – ALUs – Multipliers – High Density Memory – Field Programmable Gate Arrays - Programmable Logic Arrays - Computer arithmetic techniques for low power system – low voltage low power static Random access and dynamic Random access memories, low power clock, Inter connect and layout design.

FLOOR PLANNING **9**

Floor-planning Methods – Block Placement & Channel Definition - Global Routing - switchbox Routing - Power Distribution - Clock Distributions – Floor - planning Tips - Design Validation - Off-Chip Connections – Packages, The I/O Architecture - PAD Design.

TOTAL PERIODS 45

TEXT BOOK

1. J.Rabaey, ―Low Power Design Essentials (Integrated Circuits and Systems)‖, Springer, 2009

2. Wayne Wolf, ―Modern VLSI Design – System – on – Chip Design‖, Prentice Hall, 3rd Edition, 2008.

REFERENCES

1. J.B.Kuo& J.H.Lou, ―Low-voltage CMOS VLSI Circuits‖, Wiley, 1999.
2. A.Bellaowar & M.I.Elmasry, Low power Digital VLSI Design, Circuits and Systems, Kluwer, 1996.
3. Wayne Wolf, ―Modern VLSI Design – IP based Design‖, Prentice Hall, 4th Edition, 2008.
4. M.J.S. Smith : Application Specific Integrated Circuits, Pearson, 2003
5. Sudeep Pasricha and NikilDutt, On-Chip Communication Architectures System on Chip Interconnect, Elsevier, 2008

Course Outcomes	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO 4
CO1	3	3	3	2	1	1						2	3	3		2
CO2	3	3	3	2	2						2	2	3	3		2
CO3	3	3	3	3	3				3		2	2		3	3	3
CO4	3	3	3	3	3	2			3		2	2		3		3
CO5	3	3	3	2	2							2		3		3
CO6	3	3	3	3	3							2		3		3

Enter correlation levels 1, 2 or 3 as defined below:1: Slight (Low) 2: Moderate (Medium) 3:Substantial (High)

191ECEI	MEMS AND NEMS	L-T-P	C
		3-0-0	3

Programme: B.E. Electronics and Communication Engineering **Sem:-** **Category:** PE

AIM: The aim of the course is to exposure the concepts of Micro and Nano Electromechanical systems.

Course Outcomes: The students will be able to

CO1: Explain the basics of micro and nano electromechanical systems. (UN)
CO2: Interpret the MEMS fabrication processes.(UN)
CO3: Analyze the performance of micro sensors. (AN)
CO4: Analyze the performance of micro actuators. (AN)
CO5: Illustrate the atomic structures and quantum mechanics. (UN)
CO6: Explain the theoretical foundations of Nano systems. (UN)

INTRODUCTION TO MEMS AND NEMS **9**

Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Materials for MEMS and NEMS: Silicon, silicon compounds, polymers, metals.

MEMS FABRICATION TECHNOLOGIES **9**

Photolithography, Ion Implantation, Diffusion, Oxidation, CVD, Sputtering Etching techniques, Micromachining: Bulk Micromachining, Surface Micromachining, LIGA.

MICRO SENSORS **9**

MEMS Sensors: Design of Acoustic wave sensors, Vibratory gyroscope, Capacitive Pressure sensors, Case study: Piezoelectric energy harvester

MICRO ACTUATORS **9**

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces, Case Study:RF Switch.

NANO DEVICES **9**

Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nanorods based NEMS device: Gas sensor.

Total Periods 45

Text Book

1.Stephen Santuria," Microsystems Design", Kluwer publishers, 2006.

References

1. Nadim Maluf," An introduction to Micro electro mechanical system design", Artech House, 2000
2. Mohamed Gad-el-Hak, editor," The MEMS Handbook", CRC press Baco Raton, 2000.
3. Sergey Edward Lyshevski, ―MEMS and NEMS: Systems, Devices, and Structures‖ CRC Press, 2002
4. Tai Ran Hsu," MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	1							2		3		3
CO2	3	3	3	2	1							2		2		3
CO3	3	3	3	2	2	3						2		2		2
CO4	3	3	2	3	2	2						2		2		3
CO5	3	2	2	3	1							2				3
CO6	3	3	3	2	2	2						2	2	2		2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEJ	MOBILE ROBOTICS	L-T-P	C
		3-0-0	3

Programme: B.E.-Electronics and Communication Engineering **Sem** - **Category:** PE

AIM: The aim of the course is to demonstrate the concepts and basic algorithms needed to make a mobile robot function reliably and effectively.

Course Outcomes:

The Students will be able to

CO1: Explain about locomotion and kinematics. (UN)
CO2: Interpret the sensors for different environments. (UN)
CO3: Illustrate mobile robot localization. (UN)
CO4: Explain planning and system control techniques. (UN)
CO5: Illustrate the navigation architecture. (UN)
CO6: Apply robots for real life applications. (AP)

LOCOMOTION AND KINEMATICS **9**

Legged Mobile robots- Wheel mobile robots- Ariel mobile robots-Kinematic Models and constraints- Mobile robot maneuverability-Mobile robot workspace- Motion control

PERCEPTION, NON VISUAL SENSORS AND ALGORITHMS **9**

Sensors for mobile robots-Fundamentals for computer vision- Feature extraction- Place recognition-Range data-contact sensors- inertial sensors- infrared- sonar, radar, Laser, satellite based positioning- Data fusion - biological sensing.

MOBILE ROBOT LOCALIZATION **9**

Noise aliasing- Belief Representation- probabilistic Map based localization- Autonomous Map building Landmark based Localization, globally unique localization, Position beacons and Route based localizations.

PLANNING, NAVIGATION AND SYSTEM CONTROL **9**

Planning and reacting - Path planning- Obstacle avoidance - bug algorithm- Vector field histogram- bubble band technique - Curvature velocity technique - Dynamic window approach- Schlegel approach-Nearness diagram - gradient Method- Navigation Architectures-horizontal and vertical decomposition - Hybrid control architectures.

ROBOT APPLICATIONS **9**

Artificial intelligence in robotics - Line follower-wall follower - pick and place - Flying robots - Swarm robotics-Social Economic Application - Future of Mobile robotics.

TOTAL PERIODS: 45

TEXT BOOKS:

1.Illah Reza Nourbakhsh, Roland Siegwart, “Introduction to Autonomous Mobile Robots, MIT press, Cambridge, London, 2011.

REFERENCES:

1. Gregory Dudek, Michael Jenkin, "Computational Principles of Mobile Robotics", Cambridge university press, 2010.
2. Y Joseph L. Jones, Bruce A. Seiger, "Mobile Robots: Inspiration to Implementation", AK peters Ltd., 2002.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2							3		2		3
CO2	3	2	3	3	3							2		2		3
CO3	2	2	2	2	2							1		2		3
CO4	2	3	2	3	3							3		2		3
CO5	2	3	3	3	2							3		2		3
CO6	2	3	3	3	2							3		2		3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEK MIXED SIGNAL IC DESIGN L-T-P C
3-0-0 3

Programme: B.E. Electronics and Communication Engineering **Sem:-** **Category:PE**

Aim: To study the mixed signal of submicron CMOS circuits and understand the various integrated based filters and topologies

Course Outcomes: The students will be able to

CO1: Develop the concepts of CMOS analog and digital circuit design .(AP)
CO2: Illustrate Integrator building blocks for CMOS filters. (UN)
CO3: Develop various data converter circuits. (AP)
CO4: Analyze SNR for data converter circuits. (AN)
CO5: Determine frequency of oscillation for various oscillators. (EV)
CO6: Classify various PLL circuits. (UN)

SUBMICRON CMOS CIRCUIT DESIGN 9

Submicron CMOS: Overview and Models, CMOS process flow, Capacitors and Resistors. Digital circuit design: The MOSFET Switch, Delay Elements, An Adder. Analog Circuit Design: Biasing, Op-Amp Design, Circuit Noise.

INTEGRATOR BASED CMOS FILTERS 9

Integrator Building Blocks- low pass filter, Active RC integrators, MOSFET-C Integrators, gm-C integrators, Discrete time integrators. Filtering Topologies: The Bilinear transfer function, The Biquadratic transfer function, Filters using Noise shaping.

DATA CONVERTER ARCHITECTURES 9

DAC Architectures- Resistor string, R-2R ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, and Pipeline DAC. ADC Architectures- Flash, Two-step flash ADC, Pipeline ADC, Integrating ADC‘s, Successive Approximation ADC.

DATA CONVERTER MODELING AND SNR 9

Sampling and Aliasing: A modeling approach, Impulse sampling, The sample and Hold, Quantization noise. Data converter SNR: An overview, Clock Jitter, Improving SNR using Averaging, Decimating filter for ADCs, Interpolating filter for DACs, Band pass and High pass sinc filters - Using feedback to improve SNR.

OSCILLATORS AND PLL 9

LC oscillators, Voltage Controlled Oscillators. Simple PLL, Charge pumps PLLs, Non ideal effects in PLLs, Delay Locked Loops.

Total Periods: 45

Text Book

1.CMOS Mixed Signal Circuit Design by R.Jacob Baker, Wiley India, IEEE Press, reprint, 2008

References

1. CMOS Circuit Design, Layout and Simulation by R.Jacob Baker, Wiley India, IEEE Press, Second Edition, reprint 2009.
2. Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGraw Hill, 33rd Re-print, 2016.

Course Outcomes	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2	2						2	3	3		2
CO2	3	3	3	1	2	2						2	3	3		2
CO3	3	3	3	3	3	3			3		2	2		3	3	3
CO4	3	3	3	3	3	2			3		2	2		3		3
CO5	3	3	3	1	2	2						2		3		3
CO6	3	3	3	3	3	2						2		3		3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEL	PHOTONIC NETWORKS	L	T	P	C
		3	0	0	3

Programme: B.E. Electronics and Communication Engineering **Sem:-** **Category:**PE

Aim: To understand the importance of the photonic networks infrastructure for our present and future communication needs and familiarize them

Course Outcomes: The students will be able to

CO1: Summarize Optical system components.(UN)
CO2: Classify various Optical networks.(UN)
CO3: Develop wavelength routing networks.(AP)
CO4: Construct packet switching. (AP)
CO5: Explain various optical access networks. (UN)
CO6: Analyze the optical network design. (AN)

OPTICAL SYSTEM COMPONENTS **9**

Light Propagation in optical fibers – Loss & bandwidth, System limitations, Nonlinear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

OPTICAL NETWORK ARCHITECTURES **9**

Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Wavelength Routing Architecture.

WAVELENGTH ROUTING NETWORKS **9**

The optical layer, Optical Network Nodes, Routing and wavelength assignment, Traffic Grooming in Optical Networks, Architectural variations- Linear Light wave networks, Logically Routed Networks.

PACKET SWITCHING AND ACCESS NETWORKS **9**

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch-based networks, Contention Resolution Access Networks – Network Architecture overview, Optical Access Network Architectures and OTDM networks.

NETWORK DESIGN AND MANAGEMENT **9**

Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion, Wavelength stabilization, Overall design considerations, Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

TOTAL PERIODS 45

TEXT BOOK

1. Rajiv Ramaswami and Kumar N. Sivarajan, ―Optical Networks: A Practical Perspective‖, Harcourt Asia Pvt Ltd., Second Edition 2004.
2. C. Siva Ram Moorthy and Mohan Gurusamy, ―WDM Optical Networks: Concept, Design and Algorithms, Prentice Hall of India, Ist Edition, 2002.
3. P.E. Green, Jr., ―Fiber Optic Networks, Prentice Hall, NJ, 1993.
4. Biswanath Mukherjee, ―Optical WDM Networks‖, Springer Series, 2006.

Course Outcomes	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	1							2		3		3
CO2	3	3	3	2	1							2		2		3
CO3	3	3	3	2	2	3						2		2		2
CO4	3	3	2	3	2	2						2		2		3
CO5	3	2	2	3	1							2				3
CO6	3	3	3	2	2	2						2	2	2		2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEM	PLC AND AUTOMATION	L-T-P	C
		3-0-0	3

Programme: B.E. Electronics and Communication Engineering **Sem - Category: PE**

AIM: Toanalyze the essential elements and practices needed to develop and implement the Engineering Automation using PLC approach.

Course Outcomes: The students will be able to

CO1: Explain the process control and automation. (UN)
CO2: Interpret transmitters and signal conditioning. (UN)
CO3: Classify controllers and actuators.(UN)
CO4: Illustrate programmable logic controllerarchitecture. (UN)
CO5: Interpret human machine interface.(UN)
CO6: Explain the SCADA and Distributed Control Systems.(UN)

PROCESS CONTROL & AUTOMATION **9**

Process control principles, Servomechanisms, Control System Evaluation, Analog control, Digital control, Types of Automation; Architecture of Industrial Automation Systems, Advantages and limitations of Automation, Effects of modern developments in automation on global competitiveness.

TRANSMITTERS AND SIGNAL CONDITIONING **9**

Need of transmitters, Standardization of signals, Current, Voltage and Pneumatic signal standards, 2-Wire & 3-Wire transmitters, Analog and Digital signal conditioning for RTD, Thermocouple, DPT etc , Smart and Intelligent transmitters

CONTROLLERS AND ACTUATORS **9**

PID Controller, Cascade PID control, Microprocessor Based control, PAC (Programmable automation controller), Mechanical switches, Solid state switches, Electrical actuators: Solenoids, Relays and Contactors, AC Motor, VFD, energy conservation schemes through VFD, DC Motor, BLDC Motor, Stepper Motor, Servo Motor, Pneumatic and hydraulic Actuators.

PLC AND HUMAN MACHINE INTERFACE (HMI) **9**

Functions of PLC, Advantages, Architecture, working of PLC, Selection of PLC, Networking of PLCs, Ladder Programming, Interfacing Input and Output devices with PLC, PLC based automated systems. High frequency inputs. PLC programming standard IEC61131, Soft PLC techniques. IT Interfaces required: for ERP, MIS, MES. Supporting Applications interfaces: RFID, Barcode, Vision Systems. HMI: Block Diagram, Types, Advantages, Applications.

SCADA & DISTRIBUTED CONTROL SYSTEM **9**

Elements of SCADA, Features of SCADA, MTU-functions of MTU, RTU-Functions of RTU, Applications of SCADA, Communications in SCADA-types & methods used, Mediums used for communication, Introduction to DCS, Architecture of DCS, Input and output modules, communication module, Specifications of DCS.

TOTAL PERIODS: 45

TEXT BOOK

1.Curtis Johnson, "Process Control Instrumentation Technology"; 8th Edition, Pearson Education
2.MadhuchhandaMitra, SamarjitSen Gupta, "Programmable Logic controllers and Industrial Automation"; Penram International Publishing India Pvt. Ltd

REFERENCES

1.John W. Webb, Ronold A Reis, "Programmable Logic Controllers, Principles and Applications"; 5th Edition, Prentice Hall of India Pvt. Ltd
2.Kilian, "Modern control technology: components & systems, Delmar 2nd edition.
3.Bela G Liptak, Process software and digital networks, 3rd edition, 2002.
4.Pollack. Herman, W & Robinson., T. "Computer Numerical Control", Prentice Hall. NJ.
5.Stuart A. Boyer, SCADA supervisory control and data acquisition, ISA Publication

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3		1						2	2			2
CO2	3	3	2	3		1						2	2	2		2
CO3	2	2	3	2	1	1						2	2	2		2
CO4	3	2	2	2	1							2	2	2	1	2
CO5	3	2	2	3	1							2	2	2	1	2
CO6	3	2	2	2	1	1						2	2	2	1	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEN	QUANTUM COMPUTING	L-T-P	C
		3-0-0	3

Programme: B.E – Electronics and Communication Engineering **Sem:** - **Category:** PE

AIM: To study various quantum algorithms and error correcting codes

Course Outcomes: The Students will be able to

CO1: Illustrate the quantum basics. (UN)
CO2: Elaborate the operation of quantum gates and circuits. (CR)
CO3: Explain quantum algorithms. (UN)
CO4: Examine quantum communication and its complexity. (AN)
CO5: Develop quantum error correcting codes. (AP)
CO6: Analyze quantum key generation and cryptographic protocols.(AN)

QUANTUM BASICS 9

Introduction, Axioms of Quantum mechanics, quantum states and notation, unitaries, quantum bit (qubit), measurements, quantum gates, classical reversible circuits, quantum circuits, universality

QUANTUM ALGORITHMS 9

Teleportation, Deutsch's algorithm, Simon's algorithm, Hidden subgroup problems, Quantum Fourier transform, Shor's algorithm for factoring, Grover's algorithm

QUANTUM COMMUNICATION 9

Definition of models, Equality, Disjointness with quantum communication, Simultaneous message passing and finger prints, quantum communication complexity

QUANTUM ERROR CORRECTING CODES 9

Quantum dynamics and decoherence, Error Correction, Shor's nine-qubit error correcting code, A seven – qubit quantum error correcting code, A five-qubit error – correcting code, Stabilizers and the five-qubit code, theoretical aspects of stabilizer codes, CSS codes, Abstract quantum error correction

QUANTUM CRYPTOGRAPHY 9

Quantum Key generation, Quantum cryptographic protocols, quantum teleportation and superdense coding

TEXT BOOK

1. Jozef Gruska," Quantum Computing",Mc Graw Hill,2005

REFERENCES

1. M. A. Nielson and I. L. Chuang, "Quantum Computation and QuantumInformation", Cambr.Univ. Press, 2000.
2. A. Yu. Kitaev, A.H. Shen, M.N. Vyalyi, "Classical and Quantum Computation",Amer. Mathematical Society, 2002.
3. R. de Wolf, "Quantum Communication and Complexity", Theoretical ComputerScience,2002.
4.Arthur O.Pittenger,"An Introduction to Quantum Computing Algorithms", progress in computer science and applied logic; vol.19 ISBN 0-8176-4127-0

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2							2	2	3		2
CO2	3	2	2	2	2							2	2	3		2
CO3	3	2	2	3	2							2	2	3		2
CO4	3	3	2	2	2							2	2	3		2
CO5	3	2	2	2	2							2	2	3		2
CO6	3	3	2	2	2							2	2	3		2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEO WEARABLE ELECTRONICS L-T-P C
3-0-0 3

Programme: B.E. Electronics and Communication Engineering **Sem: - Category:** PE
AIM: To design and implement various wearable electronics systems.

Course Outcomes: The students will be able to
CO1: Explain wearable electronics technology. (UN)
CO2: Illustrate the wearable electronics fabrication process. (UN)
CO3: Classify the wearable electronics materials. (UN)
CO4: Explain the methods of wearable sheet type. (UN)
CO5: Interpret the flexible display and circuits. (UN)
CO6: Build the various wearable electronics applications. (AP)

OVERVIEW OF WEARABLE ELECTRONICS TECHNOLOGY 9
History of Flexible Electronics - Materials for Flexible Electronics - Degrees of Flexibility – Substrates Backplane Electronic – Front plane Technologies – Encapsulation - Fabrication Technology for Flexible Electronics - Fabrication on Sheets by Batch Processing - Fabrication on Web by Roll-to-Roll Processing - Additive Printing.

WEARABLE ELECTRONICS MATERIALS 9
Introduction of Materials Considerations for Flexible Electronics - Overview - Inorganic Semiconductors and Dielectrics - Organic Semiconductors and Dielectrics – Conductors- materials issue Issues of organic photovoltaic basic operation -photocurrent - dark current.

WEARABLE SHEET TYPE 9
Introduction - Sheet-type Image Scanners - Methods - Device Structure and Manufacturing Process Electronic Performance of Organic Photodiodes Organic Transistors Photo sensor Cells Issues Related to Device Processes: Pixel Stability and Resolution A Hierarchal Approach for Slow Organic Circuits The Double-Wordline and Double-Bitline Structure - A New Dynamic Second-Wordline Decoder Higher Speed Operation with Lower Power Consumption - Sheet Type Braille Displays - Manufacturing Process Electronic Performance of Braille Cells .

FLEXIBLE DISPLAY AND CIRCUITS 9
Introduction - Enabling Technologies for Flexible Backplanes and Flexible Substrate Technologies TFT Technologies for Flexible Backplanes Display Media for Flexible Displays (LCD, reflective-EP, OLED) Barrier Layers - Important Organic TFT Parameters for Electronic Systems Field-Effect Mobility - Threshold Voltage - Leakage Currents - Liquid Crystal and Electrophoretic Displays Active Matrix OLED.

APPLICATION OF WEARABLE NEARABLE 9
Photovoltaic cells – Solar cells - Photo sensor Cells - lithography - LED –LCD - OLED- Active Matrix OLED.

TOTAL PERIODS 45

TEXT BOOK
1. Alberto Salleo and William S. Wong, “Flexible Electronics Materials and Applications”, Springer, 2009.
REFERENCES
1. Mario Caironi and Yong-Young Noh, “Large Area and Flexible Electronics“, Wiley, 2015.
2. Guozhen Shen, “Flexible Electronics from materials to devices”, World Scientific,2015.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2							2		3		2
CO2	3	3	2	2	2							2		3		2
CO3	3	3	3	3	2							2		3		2
CO4	3	3	2	2	2	1						2		3		2
CO5	3	3	2	2	2	2						2		3		2
CO6	3	3	3	2	2							2		3		2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEP	SATELLITE COMMUNICATION	L-T-P	C
		3-0-0	3

Programme: B.E. Electronics and Communication Engineering **Sem:** - **Category:** PE

AIM: To become familiar with satellites and satellite services.

Course Outcomes: The students will be able to

CO1: Identify the fundamentals of satellite orbital mechanics. (AP)
CO2: Develop launching methods and technologies. (AP)
CO3: Examine the concept of Antenna TV Systems and transmission losses. (AN)
CO4: Illustrate the accurate link budget for a satellite or other wireless communications link. (UN)
CO5: Analyze modern modulation and multiple access techniques in satellite systems. (AN)
CO6: Infer about various satellite application. (UN)

SATELLITE ORBITS 9

Introduction – Frequency Allocations for Satellite Services– Kepler's First Law – Kepler's Second Law – Kepler's Third Law – Orbital Elements –Orbital Perturbations – Effects of a Nonspherical Earth – Atmospheric Drag.

SPACE SEGMENT 9

Introduction – Antenna Look Angels – The Polar Mount Antenna – Limits of Visibility – Near Geostationary Orbits – Earth Eclipse of Satellite – Sun Transit Outage – Launching Orbits – Power Supply – Attitude Control – Spinning Satellite Stabilization – Momentum Wheel Stabilization – Station Keeping – Thermal Control – TT&C Subsystem – Transponders — Power Amplifier – Antenna Subsystem.

EARTH SEGMENT AND SATELLITE LINK DESIGN 9

Introduction – Receive-Only Home TV Systems – Outdoor Unit – Indoor Unit for Analog (FM) TV – Master Antenna TV System – Community Antenna TV System – Transmit-Receive Earth Stations– Equivalent Isotropic Radiated Power – Transmission Losses – Free-Space Transmission – Feeder Losses – Antenna Misalignment Losses – Fixed Atmospheric and Ionospheric Losses – Link Power Budget Equation – Carrier-to-Noise Ratio –Combined Uplink and Downlink C/N Ratio – Intermodulation Noise.

SATELLITE ACCESS 9

Single Access – Preassigned FDMA, Demand-Assigned FDMA, SPADE System, TDMA - preassigned TDMA, Demand assigned TDMA, Code-Division Multiple Access – Direct-Sequence spread spectrum – Acquisition and trackling – Spectrum spreading and dispreading – CDMA throughput.

SATELLITE APPLICATIONS 9

INTELSAT Series, LEO, MEO, GEO, HDTV, Mobile Satellite Services: VSATs, Radarsat IRIDIUM, Global Positioning System.

TOTAL PERIODS45

TEXT BOOK

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

REFERENCES

1. Timothy Pratt – Charles Bostian & Jeremy Allmuti, Satellite Communications, John Willy & Sons (Asia) Pvt. Ltd. 2004
2. Wilbur L. Pritchars Henri G.Suyder Hond Robert A.Nelson, Satellite Communication Systems Engineering, Pearson Education Ltd., Second edition 2003.
3. Richharia.M : Satellite Communication Systems (Design Principles Macmillan Press Ltd. Second Edition 2003.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2								2	3			
CO2	3	3	3	3	1				2			2	3	2		
CO3	3	3	3	2	1							2	3	2	2	
CO4	3	3	2	2	2				2			2	3		2	
CO5	3	3	3	2	2				1			2	3			
CO6	3	3	3	3	3	2			2			2	3	2	2	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEQ SATELLITE REMOTE SENSING AND DATA ANALYSIS L-T-P C

3-0-0 3

Programme: B.E. Electronics and Communication Engineering **Sem:** - **Category:** PE

AIM: To analyze image acquisition and preprocessing of satellite images

Course Outcomes: The Students will be able to

The Students will be able to

CO1. Explain the basic concepts of remote sensing process. (UN)
CO2. Categorize the satellite data preprocessing techniques. (AN)
CO3. Analyze the satellite image enhancement techniques. (AN)
CO4. Explain the data transformation techniques in remote sensing. (UN)
CO5. Interpret various data analysis techniques. (UN)
CO6. Illustrate the data compression techniques. (UN)

REMOTE SENSING PROCESS 9

Definition, Remote sensing process, Radiation principles, Spectral reflectance curve, EMR interactions with atmosphere- earth surface features.

SATELLITE DATA 9

Satellite image characteristics, Resolution types, Preprocessing-Geometric correction, Radiometric correction.

SATELLITE IMAGE ENHANCEMENT 9

Radiometric Enhancement-Histogram Based Enhancements, Density Slicing, Stretching, Geometric Enhancement – Neighborhood Operations, Template Operators.

DATA TRANSFORMATION 9

Spectral Transform – Multispectral Ratios – vegetation Indexes, Principal Components, Tasseled – Cap Components, Color – Space transforms, Spatial transforms – Convolution, Fourier transform, Scale Space Transforms.

IMAGE ANALYSIS AND UNDERSTANDING 9

Feature Extraction – Statistical, Structural Spectral, Training – Supervised, Unsupervised, Hybrid Training, Data Fusion-Feature Space fusion, Spatial domain fusion, Scale space fusion, Data Compression: compression by coding fractal compression, wavelet Compression.

TOTAL PERIODS 45

TEXT BOOK

1.Thomas M.Lilles and, Ralph W.Kiefer, ‘Remote Sensing and Image Interpretation’, Fifth Edition, 2004.

REFERENCES

1. Robert A. Schowengerdt, ‘Remote Sensing Models & Methods For Image Processing, third Edition, 2004
2. J. A. Richards, ‘Remote Sensing Digital Image Analysis: An Introduction’, second Revised Edition,

1993
3. John R. Jensen, 'Remote Sensing Of The Environment – An Earth Resource Perspective', Pearson Education Series, 2003
4. Rafael C.Gonzalez, Richard E.Woods, 'Digital Image Processing' (third Edition), Prentice Hall, 2007.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	3	2	2							2	2		2	2
CO2	3	3	3	2	2	2						2		2	2	2
CO3	3	3	3	2	2	2						2	1	2	3	2
CO4	3	3	3	2	2	1						2	3	2	2	2
CO5	3	3	3	2	2	2	2					2	2	2	3	2
CO6	3	3	3	2	2	2	2	1			2	2	3	3	2	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECER	SMART RADAR SYSTEMS	L-T-P	C
		3-0-0	3

Programme: B.E. Electronics and Communication Engineering **Sem:-** **Category:** **PE**

AIM: To make the students understand the basic concepts of Radar and its applications in wireless smart systems

Course Outcomes: The students will be able to

CO1: Explain the basics of RADAR systems. (UN)
CO2: Demonstrate the detection of signals in noise and RADAR signals.(UN)
CO3: Analyze the characteristics of RADAR transmitter and receiver.(AN)
CO4: Illustrate the characteristics of RADAR Antenna. (UN)
CO6: Analyze the effect of errors on radiation patterns. (AN)
CO5: Interpret the operation of MTI and Pulse Doppler RADAR. (UN)

INTRODUCTION TO RADAR **9**

Basics of radar, EM Waves & properties- applications of radar, radar frequencies-radar block diagram, Radar Coordinates, Radar equation for hard targets and the SNR-radar cross section of targets, Radar Resolution Elements, Pulse, CW and FMCW Radars–configurations, transmitter power- pulse repetition frequency, Duty Ratio, Pulse Compression, Coding.

DETECTION OF SIGNALS IN NOISE AND RADAR SIGNALS **9**

Introduction to Noise in detail, probability density functions – probabilities of detection and false alarm-matched filter receiver-detection criteria – integration of radar pulses – constant-false alarm rate receivers – Radar Wave forms, Pulse Compression, Ambiguity Diagram.

RADAR TRANMIMTTER AND RECEIVER **9**

Introduction- Types of Transmitters – linear-beam power tubes- solid-state RF power sources- magnetron-Klystron, crossed-filed amplifier- radar receiver- receiver noise figure- super heterodyne receiver, Digital Receivers, duplexers and receiver protectors- radar displays-Human Machine Interface (HMI).

RADAR ANTENNA **9**

Functions of radar antenna- antenna parameters- antenna radiation pattern and aperture illumination – reflector antennas- electronically steered phased array antennas- phase shifters – frequency – scan arrays– architectures for phased arrays , radiators for phased arrays- mechanically steered planar array antennas-radiation pattern synthesis –effect of errors on radiation patterns – low side lobes antennas.

MTI AND PULSE DOPPLER RADAR **9**

Introduction to Doppler and MTI radar- delay –line cancellers- staggered pulse repetition frequencies-136oppler filter banks- digital MTI processing – Moving target detector- limitations to MTI performance-pulse Doppler radar-MTD, Tracking radar- monopulse tracking- conical scan and sequential lobing-comparison of trackers. Tracking accuracylow-angle tracking- Atmospheric & Weather Radars: Precipitation Radars, Doppler Weather Radar, Polarimetric Radar, Clear Air Radars.

TOTAL PERIODS **45**

TEXT BOOKS

1. Merrill I. Skolnik ," Introduction to Radar Systems", Tata McGraw-Hill (3rd Edition) 2008.
2. Richard J Doviak and Dusan S Zrnic, "Doppler Radar and Weather Observations", Dover Publications,1993.

REFERENCES

2. Bringi V. N and Chandrasekar V, "Polarimetric Doppler Weather Radar ", Cambridge University Press,2001.
2. Richards M. A, Scheer J A and Holm W A, "Principles of Modern Radar", Yes Dee Publishing Pvt. Ltd., 2012.

Course Outcomes	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2								2	3	2		3
CO2	2	3	2	2	1							2	3	2	2	3
CO3	3	2	2	3	1							2	3	2	2	3
CO4	3	3	2	2	1	1						2	3	2	2	3
CO5	3	2	2	2	2	1						2	3	2	2	3
CO6	2	2	2	2	2	1						2	3	2	2	3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECES SMART STRUCTURES AND SMART MATERIALS L-T-P C

3-0-0 3

Programme: B.E. Electronics and Communication Engineering **Sem: - Category** PE

AIM: To illustrate the latest developments regarding smart materials and apply them in designing smart structures.

Course Outcomes: The students will be able to

CO1: Classify the smart materials and sensing systems. (UN)
CO2: Explain the measurement techniques for the transducers. (UN)
CO3: Show the various measurements using sensors. (UN)
CO4: Build the actuation techniques. (AP)
CO5: Identify the role of actuators. (AP)
CO6: Explain the signal processing in control Systems. (AP)

INTRODUCTION **9**

Introduction to Smart Materials and Structures – Instrumented structures functions and response – Sensing systems – Self diagnosis – Signal processing consideration – Actuation systems and effectors.

MEASURING TECHNIQUES **9**

Strain Measuring Techniques using Electrical strain gauges, Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

SENSORS **9**

Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers – The LVOT – Fiber optic Techniques. Chemical and Bio-Chemical sensing in structural Assessment – Absorptive chemical sensors – Spectroscopes – Fibre Optic Chemical Sensing Systems and Distributed measurement.

ACTUATORS **9**

Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magnetostructure Material – Shape Memory Alloys – Electro orheological Fluids– Electro magnetic actuation – Role of actuators and Actuator Materials.

SIGNAL PROCESSING AND CONTROL SYSTEMS **9**

Data Acquisition and Processing – Signal Processing and Control for Smart Structures – Sensors as Geometrical Processors – Signal Processing – Control System – Linear and Non-Linear.

TOTAL PERIODS 45

TEXT BOOK

1 Mel Schwartz,"Smart Materials", Tata McGraw-Hill 2008

REFERENCES

1 . L. S. Srinath – Experimental Stress Analysis – Tata McGraw-Hill, 2000.
2. J. W. Dally & W. F. Riley – Experimental Stress Analysis – Tata McGraw-Hill, 2002.

Course Outcomes	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	1		2					2	2	2	2	3
CO2	3	2	3	2	2	1						2		3	2	3
CO3	3	3	3	2	2							2		2		2
CO4	3	2	3	2	2							2		2		3
CO5	3	3	3	2	2	1						2		2		3
CO6	3	3	3	2	2	1						2	2	2	3	3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECET	VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

Programme: B.E. Electronics and Communication Engineering **Sem:-** **Category:** PE

AIM: To process a digital video signal using a special algorithm to perform a security related function.

Course Outcomes: The students will be able to

CO1: Explain video analytic components. (UN)
CO2: Classify the various techniques for foreground extraction. (UN)
CO3: Illustrate various classifiers for video analytics.(UN)
CO4: Interpret techniques in video analytics for security. (UN)
CO5: Design video analytic algorithms for business intelligence.(AP)
CO6: Develop video analytic algorithms for traffic monitoring.(AP)

VIDEO ANALYTIC COMPONENTS **9**

Need for Video Analytics-Overview of video Analytics- Foreground extraction- Feature extraction-classifier - Preprocessing- edge detection- smoothening- Feature space-PCA-FLD-SIFT features

FOREGROUND EXTRACTION **9**

Background estimation- Averaging- Gaussian Mixture Model- Optical Flow based- Image Segmentation- Region growing- Region splitting-Morphological operations- erosion-Dilation-Tracking in a multiple camera environment

CLASSIFIERS **9**

Neural networks (back propagation) - Deep learning networks- Fuzzy Classifier- Bayesian classifier-HMM based classifier

VIDEO ANALYTICS FOR SECURITY **9**

Abandoned object detection- human behavioral analysis -human action recognition- perimeter security- crowd analysis and prediction of crowd congestion

VIDEO ANALYTICS FOR BUSINESS INTELLIGENCE & TRAFFIC MONITIRING AND ASSISTANCE **9**

Customer behavior analysis - people counting- Traffic rule violation detection- traffic congestion identification for route planning- driver assistance- lane change warning

TOTAL PERIODS 45

TEXT BOOK

1.Graeme A. Jones (Editor), Nikos Paragios (Editor), Carlo S. Regazzoni (Editor) Video-Based Surveillance Systems: Computer Vision and Distributed Processing , Kluwer academic publisher, 2001

REFERENCES

1. Nilanjan Dey (Editor), Amira Ashour (Editor) and Suvojit Acharjee (Editor), Applied Video Processing in Surveillance and Monitoring Systems (IGI global) 2016
2. Zhihao Chen (Author), Ye Yang (Author), Jingyu Xue (Author), Liping Ye (Author), Feng

Guo (Author), The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite, CreateSpace Independent Publishing Platform, 2014
3. Caifeng Shan (Editor), Fatih Porikli (Editor), Tao Xiang (Editor), Shaogang Gong (Editor) Video Analytics for Business Intelligence, Springer, 2012

Course Outcomes	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3	PSO 4
CO1	3	3	3	2	2							3	2	2		3
CO2	3	2	3	3	3							2	2	2		3
CO3	2	2	2	2	2							1	2	2		3
CO4	2	3	2	3	3							3	2	2		3
CO5	2	3	3	3	2							3	2	2		3
CO6	3	2	3	3	3							2	2	2		3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

		L	T	P	C
191ECEU	**VIRTUAL REALITY AND AUGMENTED REALITY**	**3**	**0**	**0**	**3**

Programme: B.E. Biomedical Engineering **Sem:** 3 **Category:** PE

Aim: To study the virtual reality, augmented reality and using them to build Biomedical engineering applications

Course Outcomes: The Students will be able to

CO1: Explain the basics of virtual reality. (UN)
CO2: Summarize the virtual reality development process. (UN)
CO3: Illustrate the content creation considerations for virtual reality. (UN)
CO4: Interpret the augmented reality on the web. (UN)
CO5: Explain virtual reality on the mobile. (UN)
CO6: Illustrate the applications of virtual and augmented reality. (UN)

INTRODUCTION **9**

The three I's of virtual reality-commercial VR technology and the five classic components of a VR system - Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces-Output Devices: Graphics displays-sound displays & haptic feedback.

VR DEVELOPMENT PROCESS **9**

Geometric modelling - kinematics modelling- physical modelling - behavior modelling - model Management.

CONTENT CREATION CONSIDERATIONS FOR VR **9**

Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality environment.

VR ON THE WEB & VR ON THE MOBILE **10**

JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)-frameworks (A-frame, React VR)-Google VR for Android-Scripts, mobile device configuration, building to android-cameras and interaction-teleporting-spatial audio-Assessing human parameters-device development and drivers-Design Haptics.

APPLICATIONS **8**

Medical applications-military applications-robotics applications- Advanced Real time Tracking-other applications- games, movies, simulations, therapy.

Total Periods: 45

Text Books:

1. C. Burdea & Philippe Coiffet, ―Virtual Reality Technology‖, Second Edition, Gregory, John Wiley & Sons, Inc.,2008
2. Jason Jerald. 2015. The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool, New York, NY, USA.

References:

1. Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg & Tobias Hollerer, Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016. ISBN: 9780321883575
2. Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability), Steve Aukstakalnis, Addison-Wesley Professional; 1 edition, 2016.
3. The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything, Robert Scoble & Shel Israel, Patrick Brewster Press; 1 edition, 2016.

4. Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, Tony Parisi, O'Reilly Media; 1 edition, 2015.
5. Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages, Tony Parisi, O'Reilly Media; 1 edition, 2014.
6. Learning Three.js: The JavaScript 3D Library for WebGL - Second Edition, Jos Dirksen, Packt Publishing - ebooks Account; 2nd Revised ed. Edition 2015.

Course Outcomes	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	1		2					2	2	2	2	3
CO2	3	2	3	2	2	1						2		3	2	3
CO3	3	3	3	2	2							2		2		2
CO4	3	2	3	2	2							2		2		3
CO5	3	3	3	2	2	1						2		2		3
CO6	3	3	3	2	2	1						2	2	2	3	3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191ECEV **RFID AND ITS APPLICATIONS** **L-T-P** **C**

3-0-0 **3**

Programme: B.E. Electronics and Communication Engineering **Sem: -** **Category: PE**

AIM: This course aims to elaborate the concepts, architecture of RFID and its applications.

Course Outcomes: The students will be able to
CO1: Extend knowledge about the RFID fundamentals. (UN)
CO2: Explain the RFID system principles. (UN)
CO3: Develop knowledge about the RFID system architecture. (AP)
CO4: Choose RFID standards. (AP)
CO5: Examine various transponders. (AN)
CO6: Develop RFID applications.(AP)

RF FUNDAMENTALS **9**

RF operating principle – Frequency divider –Coupling – Inductive coupling, Electromagnetic back scatter coupling, close coupling, Electrical coupling – Frequency ranges used in RF Coding- Digital Modulation – ASK,FSK,PSK.

RFID SYSTEM PRINCIPLES **9**

RFID systems – Component of an RFID System – Frequency, Range & Coupling – Transponder & Reader System – Equivalent Circuit – RFID Antennas: Antenna Parameters – Gain & directional effect, EIRP & ERP, Input impedance, Effective aperture and scatter aperture Effective length Antenna types – Dipole antennas, Yagi – Uda Antenna, Patch or micro strip antenna & slot antenna

RFID SYSTEM ARCHITECTURE **9**

Architecture of Transponder – HF interface, Address & Security logic, Memory architecture Microprocessors. Architecture of Reader - Components, Control Unit, Example – Reader IC U2270B, Connection of Antennas for inductive systems

RFID STANDARDIZATION AND MEMORY ORGANIZATION **9**

Animal Identification – ISO 11784 Code structure — ISO 11785 — Technical concept – Full/half duplex system - Sequential system – ISO 14223 — Advanced transponders – Air interface — Code and command structure - Read-only transponder - Writable transponder-Transponder with crypto logical function.

RFID APPLICATIONS **9**

Example Applications – Contact less Smart Cards, Public Transport, Ticketing, and Access control Transport Systems, Animal Identification. Electronic immobilization, Container Identification, Identification, Waste Disposal, Industrial Automation, Medical Applications.

TOTAL PERIODS45

TEXT BOOK

1. Finkenzeller.K, RFID Handbook: Fundamentals and Applications in contact less smart cards and identifications, John Wiley and sons Ltd, 2003

REFERENCES

1. Bill Glover and Himanshu Bhatt, RFID Essentials, Oreilly, 2006.
2. Patrick J.Sweeney II, RFID for Dummies, Wiley Publishing, Inc .
3. Sandip Lahiri, RFID Handbook, IBM, 2006.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3		1						2	2			2
CO2	3	3	2	3		1						2	2	2		2
CO3	2	2	3	2	1	1						2	2	2		2
CO4	3	2	2	2	1							2	2	2	1	2
CO5	3	2	2	3	1							2	2	2	1	2
CO6	3	2	2	2	1	1						2	2	2	1	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

OPEN ELECTIVES

191OE2A	**AGRICULTURE ELECTRONICS**	**L-T-P**	**C**
		3-0-0	**3**

Programme: B.E. Electronics and Communication Engineering **Sem:** - **Category:** OE

AIM: To develop an electronics platform to raise the standards of agriculture

Course Outcomes: The students will be able to

CO1: Explain the basics of agriculture. (UN)
CO2: Demonstrate the functionality of transducers used in agriculture. (UN)
CO3: Illustrate the various meteorological instruments utilized in agriculture. (UN)
CO4: Apply the computer technologies in agriculture. (AP)
CO5: Summarize the concept of various information technologies in agriculture. (UN)
CO6: Analyze the functionality of microprocessor in agriculture applications. (AN)

BASICS OF AGRICULTURE **9**

Introduction to Soil Science- Soil structure, Soil properties, Soil processes, Formation of Soil, types of soils, Soil as a medium for plant growth, Soil moisture & efficiency, soil pH values, Chemical analysis of soil, water bearing capacity, Soil erosion and conservation, measurement of soil parameters. Basic principles and advances in photosynthesis. Role of fertilizers, Different types of crops eg. Floriculture, Horticulture

9

AGRICULTURE TRANSDUCERS

Introduction - transducer-functions and characteristics of transducer - displacement and motion transducer - temperature transducer - pressure transducer - grain moisture transducer - soil moisture transducer - humidity transducer - pH transducer - Gas transducer - intelligent sensors.

INTRODUCTION TO AGRO METEOROLOGY **9**

Agro meteorological instruments: Anemometer, Use of PLDs, Microprocessors and Microcontroller, Data converters, Display devices, in agricultural automation. Use of opto-electronic devices for measurement and control of physical parameters in agri - Automatic drip irrigation- Green House Instrumentation: Green House Technology introduction, instrumentation required for tissue culture techniques.

COMPUTERS AND SPECIAL INFORMATION TECHNOLOGY IN AGRICULTURE **9**

SIT, GIS/ GPS software's Applications for Ground water modeling-crop forecasting & estimate-soil erosion etc-Use of Digital Image processing-Satellite missions-Hyper spectral remote sensing-physics of optical & microwave remote sensing-thermal mapping.-imulators used for study of crop growth-Data logger, features of data loggers-data loggers for dedicated use in agriculture-Computer based automatic weather station.

MICROPROCESSOR APPLICATIONS IN AGRICULTURE **9**

Microprocessor based systems- Microprocessor based grain moisture measurements-Microprocessor based safe grain storage system monitoring- Microprocessor based soil nutrient estimation systems-drip irrigation instruments-supervisory control and data acquisition systems-Introduction to precision agriculture.

Total Periods 45

TEXT BOOK

1. Krishna kant, "Microprocessor-Based Agri Instrumentation",1st edition, PHI, 2008

REFERENCES

1.George Joseph, "Fundamentals of remote sensing", Second Edition, University Press, 2005.
2.V.N. Sahi, "Fundamentals of Soil" Kalyani Publication, 2004
3.T.P.Ojha and A.M. Michale, "Principles of Agricultural Engineering", Jain Brothers Publications, 2005.
4. I.V. Muralikrishna , "Spatial information technology " Volume I & II, B.S.Publications, 2001

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2		2					2		3		3
CO2	3	2	2	2	2	1	2					2		3		3
CO3	3	3	2	2	2	1	2					2		3		3
CO4	3	2	2	2	2	2	2					2		3		3
CO5	3	3	2	2	2	2	2					2		3		3
CO6	3	2	2	2	2	2	2					2		3		3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191OE2B	CONSUMER ELECTRONICS	L-T-P	C
		3-0-0	3

Programme: B.E. Electronics and Communication Engineering **Sem** - **Category:** **OE**

AIM: To illustrate the domestic consumer and entertainment electronics.

Course Outcomes: The Students will be able to

CO1: Demonstrate the operating principles of different types of loudspeaker and microphones. (UN)
CO2: Explain the magnetic recording and reproduction. (UN)
CO3: Interpret optical recording and reproduction. (UN)
CO4: Explain the television standards and systems. (UN)
CO5: Analyze the function of washing machine and microwave oven with block diagram. (AN)
CO6: Illustrate the working principles of air conditioning and refrigeration system (UN)

LOUDSPEAKERS AND MICROPHONES **9**

Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters - Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones.

MAGNETIC RECORDING AND REPRODUCTION **9**

Magnetic recording and playback – magnetic erasing – recording medium – cassettes – tape speeds – MUF – Track Configuration – Tape transport mechanism – mechanical and electronic controls – TAPE Vs Disc

OPTICAL RECORDING AND REPRODUCTION **9**

Audio Disc – Processing of the Audio signal –read out from the Disc – Reconstruction of the audio signal – Video Disc – Video disc formats- recording systems – Playback Systems, The CD player, CD-ROM, Digital Audio tape,Video Cassette Recorders: Comparison to audio tape recording, Encoding, The conceptual VCR, Non idealities and their solutions, Remaining VCR Circuitry, a real VCR, special effects, enhancements.

TELEVISION STANDARD AND SYSTEMS **9**

Components of a TV system – interlacing – composite video signal. Colour TV –Luminance and Chrominance signal; Monochrome and Colour Picture Tubes - Colour TV systems – NTSC, PAL, SECAM - Components of a Remote Control, HDTV

HOME APPLIANCES **9**

Basic principle and block diagram of microwave oven; washing machine hardware and software; components of air conditioning and refrigeration systems.

TOTAL PERIODS 45

TEXT BOOKS

1. S.P.Bali, “Consumer Electronics”, Pearson Education,4th impression, 2011.
2. B.R.Gupta, “Consumer Electronics”, S.K.Kataria&Sons, 2011

REFERENCES

1. R.G.Gupta, “Audio and Video Systems”, Tata McGraw Hill, 2010.
2. K. Blair, Benson “Audio Engineering Hand book”, 2001
3. R.R Gulati, “Complete Satellite & Cable Television”, New age International Publisher, 2008
4. Philip Hoff,”Consumer Electronics for Engineers”, Cambridge University Press ISBN 9780521582070, 1998

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	1							2	2	3	2	3
CO2	3	3	3	2	2	2						2	2	3	2	3
CO3	3	2	2	2	1	1						2		3	3	2
CO4	3	2	2	2								2	2	3		2
CO5	3	2	2	2	1	2						2	2	3	2	2
CO6	3	2	2	2	2	2						2		3	2	3

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191OE2C	MEDICAL ELECTRONICS	L-T-P	C
		3-0-0	3

Programme: B.E. Electronics and Communication Engineering **Sem:** - **Category:** OE

AIM: To understand the applications of electronics in diagnostic and therapeutic area.

Course Outcomes: The Students will be able to
CO1: Demonstrate different bio potentials and their recording methods. (UN)
CO2: Explain measurements of biochemical and nonelectrical parameters. (UN)
CO3: Examine the working of Heart assist devices. (AN)
CO4: Develop biotelemetry system. (AP)
CO5: Apply modern imaging systems in the medical field. (AP)
CO6: Extend recent trends in biomedical instrumentation.(UN)

ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING **9**

The origin of Bio-potentials; Bio potential electrodes, Biological amplifiers, ECG, EEG,EMG, PCG, EOG, lead systems and recording methods, typical waveforms and signal characteristics.

BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT **9**

Colorimeter, photometer, Spectrophotometer, pH, pO2, pCO2,Complete Blood gas analyzers, Blood flow meter, cardiac output, Pulmonary function analyzers, Blood pressure, temperature, pulse, Blood cell counters.

ASSIST DEVICES AND BIO-TELEMETRY **9**

Cardiac pacemakers, Cardiac Defibrillators, Wireless telemetry, single channel telemetry systems, Multichannel telemetry systems, Implantable Telemetry Systems, Telemedicine

MODERN IMAGING SYSTEMS **9**

X-ray Machines and Digital radiography, X ray Computed Tomography, Nuclear Medical Imaging Systems, Magnetic Resonance Imaging System

RECENT TRENDS IN MEDICAL INSTRUMENTATION **9**

Laserapplications in biomedical field, Physiotherapy and Electrotherapy equipment, Electrical safety in medical equipment.

TOTAL PERIODS 45

TEXT BOOK

1. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TATA McGraw-Hill, NewDelhi, 2010.

REFERENCES

1. Leislie Cromwell, “Biomedical instrumentation and measurement”, Prentice Hall of India, New Delhi, 2007.
2. Joseph J.Carr and John M.Brown, “Introduction to Biomedical equipment Technology”, John Wiley and Sons, New York, 2004.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2							2	2		2	2
CO2	3	3	3	2	2	2						2		2	2	2
CO3	3	3	3	2	2	2						2	1	2	3	2
CO4	3	3	3	2	2	1						2	3	2	2	2
CO5	3	3	3	2	2	2	2					2	2	2	3	2
CO6	3	3	3	2	2	2	2	1			2	2	3	3	2	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191OE2D	MULTIMEDIA COMPRESSION AND COMMUNICATION	L-T-P	C
		3-0-0	3

Programme: B.E. Electronics and Communication Engineering **Sem:-Category** OE

AIM: To develop the concepts of multimedia communication.

Course Outcomes: The Students will be able to

CO1: Explain the components of multimedia communication. (UN)
CO2: Interpret the various audio, video compression standards. (UN)
CO3: Develop the text and image compression techniques. (AP)
CO4: Interpret VOIP technology. (UN)
CO5: Illustrate the multimedia networking. (UN)
CO6: Explain multimedia networking services. (UN)

MULTIMEDIA COMPONENTS 9

Introduction - Multimedia skills - Multimedia components and their characteristics - Text, sound, images, graphics, animation, video, hardware.

AUDIO AND VIDEO COMPRESSION 9

Audio compression–DPCM-Adaptive PCM –adaptive predictive coding-linear Predictive coding-code excited LPC-perpetual coding Video compression –Principles-H.261-H.263-MPEG 1, 2, and 4.

TEXT AND IMAGE COMPRESSION 9

Compression principles-source encoders and destination encoders-lossless and loss compressionentropy encoding –source encoding -text compression –static Huffman coding– arithmetic coding –Lempel ziv-welsh Compression-image compression

VOIP TECHNOLOGY 9

Basics of IP transport, VoIP challenges, H.323/ SIP –Network Architecture, Protocols,Call establishment and release, Quality of Service- CODEC Methods- VOIP applicability

MULTIMEDIA NETWORKING 9

Multimedia networking -Applications-streamed stored and audio-making the best Effort service protocols
for real time interactive Applications-distributing multimedia-beyond best effort service scheduling and policing Mechanisms-integrated services-differentiated Services-RSVP.

TOTAL PERIODS 45

TEXT BOOKS

1. Fred Halshall “Multimedia communication - Applications, Networks, Protocols and Standards”,Pearson Education, 2007.
2. Kurose and W.Ross “Computer Networking “a Top Down Approach”, Pearson Education,2005

REFERENCES

1.Tay Vaughan, "Multimedia: Making it work", 7th Edition, TMH 2008
2. Marcus Goncalves "Voice over IP Networks", Mc Graw Hill 1999.
3. KR. Rao,Z S Bojkovic, D A Milovanovic, "Multimedia Communication Systems: Techniques, Standards, and Networks", Pearson Education 2007.
4. R. Steimnetz, K. Nahrstedt, "Multimedia Computing, Communications and Applications", Pearson Education Ranjan Parekh, "Principles of Multimedia", TMH 2007.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2								2	3	2	3	2
CO2	3	3	2	2								2	3		3	2
CO3	3	2	2	2	2	2						2	3		3	2
CO4	3	3	2	2	2			2				2	3		2	2
CO5	3	3	2	2	2							2	3	3	2	2
CO6	3	3	2	2								2	3		2	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MANAGEMENT ELECTIVES

		L	T	P	C
191BAEA	**ENGINEERING ECONOMICS AND ACCOUNTING**	**3**	**0**	**0**	**3**

Programme: B.E. / B.Tech **Sem: -- Category: OE**

Aim: To enable the students and provide an analytical idea about economics and accounting practices.

Course Outcomes: The students will be able to

CO1: Evaluate the economic theories, cost concepts and major economic problems.(EV)

CO2: Make use of the knowledge about Demand, Supply and its types.(AP)

CO3: Explain the concept of theory of production (UN)

CO4: Determine the recent pricing methods in market and prepare internal rate of return, payback period, net present value for project selection.(EV)

CO5: Elaborate accounting systems and analyze financial statements using ratio analysis.(AN)

CO6: Illustrate an analytical idea about financial feasibility.(UN)

INTRODUCTION TO ECONOMICS& DEMAND **9**

Managerial Economics - Relationship with other disciplines - Firms: Types, objectives and goals - Managerial decisions - Decision analysis. Demand - Types of demand - Determinants of demand - Demand function - Demand elasticity - Demand forecasting.

SUPPLY, PORDUCTION AND COST CONCEPTS **9**

Supply - Determinants of supply - Supply function - Supply elasticity. **Production function** - Introduction - Production Process & Function - One Variable and Two Variable Inputs - Isoquants - Returns to scale. **Cost Concepts** - Cost function – Types of Cost - Determinants of cost - Short run and Long run cost curves - Cost Output Decision - Estimation of Cost.

PRICING AND CAPITAL BUDGETING **9**

Pricing - Determinants of Price - Pricing under different objectives and different market structures - Price discrimination - Pricing methods in practice. **Capital Budgeting -** Investments - Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value - Internal rate of return.

FINANCIAL ACCOUNTING **9**

Financial Accounting - Trail Balance, Balance sheet and related concepts: Trading Account, Profit & Loss Statement and related concepts - Analysis & Interpretation of financial statements - Financial Ratio Analysis.

COST ACCOUNTING **9**

Cost Accounting - Types of costing - traditional costing approach - activity based costing - full cost pricing - marginal cost pricing - going rate pricing - bid pricing - feasibility reports - technical, economic and financial feasibility.

Total Periods: 45

Text Books:

1. McGuigan, Moyer and Harris, 'Managerial Economics; Applications, Strategy and Tactics, Cengage Learning, 13th Edition, 2013.
2. Prasanna Chandra. 'Fundamentals of Financial Management', Tata McGraw Hill Publishing Ltd., 8th Edition, 2011.

References:

1. Paresh Shah, 'Basic Financial Accounting for Management', Oxford University Press, New Delhi, 2007.
2. Sasmitha Mishra, ‘Engineering Economics and costing’, PHI Learning, 2nd Edition, 2010.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1						3					3					
CO2											3	2				
CO3											3					
CO4											3					
CO5											3					
CO6											3	1				

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191BAEB ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

Programme: B.E. / B.Tech **Sem:** -- **Category:** OE

Aim: To develop and strengthen entrepreneurial quality and motivation in students and impart basic entrepreneurial skills and understandings to run a business efficiently and effectively.

Course Outcomes: The students will be able to

CO1: Explain the idéologies of entrepreneur.(UN)

CO2: Demonstrate a solid fundamental knowledge of entrepreneur and their successful characteristics within the broad field of entrepreneurism.(UN)

CO3: Analyze to how prepare the feasible business plan and project reports for initiating businesses.(AN)

CO4: Identify the ways to get financing for starting up the business and taxation issues.(AP)

CO5: Categorize the ways of sickness in business and its turnout initiatives by the Government policies.(UN)

CO6: Develop and strengthen entrepreneurial quality and motivation in students and impart basic entrepreneurial skills.(AP)

ENTREPRENEURSHIP **9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Entrepreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth. Entrepreneur Vs. Entrepreneurship, Entrepreneur Vs. Manager.

MOTIVATION **9**

Attributes and Characteristics of a successful Entrepreneur, Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self-Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.-women Entrepreneurs.

BUSINESS PLAN PREPARATION **9**

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

FINANCING AND ACCOUNTING **9**

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

SUPPORT TO ENTREPRENEURS **9**

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures – Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

Total Periods: 45

Text Books:

1. Hisrich, Entrepreneurship, Edition 9, Tata McGraw Hill, New Delhi, 2014
2. S. S. Khanka, Entrepreneurial Development, S.Chand and Co. Ltd., New Delhi, (Revised Edition), 2013.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1						3			3		3	3				
CO2						3			2		2	2				
CO3											1					
CO4								1				1				
CO5											2					
CO6									3	1	2	1				

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191BAEC ESSENTIALS OF MANAGEMENT

L	T	P	C
3	0	0	3

Programme: B.E. / B.Tech **Sem:** -- **Category:** OE

Aim: To study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

Course Outcomes: The students will be able to

CO1: Demonstrate knowledge of managerial functions, types of organizations, managers, and managerial roles and skills. (UN)

CO2: Apply the planning, organizing and control processes.(AP)

CO3: Analyze organizational structure, and organizational control and culture.(AN)

CO4: Explain motivation and leadership qualities and effective communicate through both oral and written presentations.(UN)

CO5: Analyze information by using both human and technological resources.(AN)

CO6: Illustrate the control management system and process.(UN)

INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS **9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations, system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

PLANNING **9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

ORGANISING **9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

DIRECTING **9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

CONTROLLING **9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

Total Periods: 45

Text Books:

1. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global & Entrepreneurial Perspective', Tata McGraw Hill, 12th edition, 2014.
2. James A.F. Stoner, R. Edward Freeman, Daniel R. Gilbert Jr., 'Management ', Prentice-Hall of India, 6th edition, 2012.

References:

1. JAF Stoner, Freeman R.E and Daniel R Gilbert 'Management', 6th Edition, Pearson Education, 2004.
2. Robert Kreitner & Mamata Mohapatra, 'Management', Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, 'Fundamentals of Management', 7th Edition, Pearson Education, 2011.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1									3		3	1				
CO2									3		3					
CO3						2		2								
CO4									1	3						
CO5					3						2					
CO6					1						3					

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191BAED PROFESSIONAL ETHICS IN ENGINEERING

L	T	P	C
3	0	0	3

Programme: B.E. / B.Tech **Sem: -- Category: OE**

Aim: To enable the students to create an awareness on Engineering Ethics and Human Values.

Course Outcomes: The students will be able to

CO1: Explain human values in professional society.(UN)

CO2: Identify the core values that shape the ethical behavior of an engineer.(AP)

CO3: Illustrate codes of conduct and responsibilities of engineers in professional society to ensure balanced outlook. (UN)

CO4: Explain the awareness about ethical concerns and conflicts.(UN)

CO5: Interpret the ability to recognize and resolve ethical dilemmas.(UN)

CO6: Apply moral and social ethics and loyalty and to appreciate the rights of others.(AP)

HUMAN VALUES **9**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

ENGINEERING ETHICS **9**

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

SAFETY, RESPONSIBILITIES AND RIGHTS **9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

GLOBAL ISSUES **9**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

Total Periods: 45

Text Books:

1. Mike Martin and Roland Schinzinger, 'Ethics in Engineering', McGraw Hill, New York, 2012.
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, 'Engineering Ethics – Concepts and Cases', 6th Edition, Ray James, Elian Englehardt Wadsworth publishing co, 2013.

References:

1. Charles D Fleddermann, 'Engineering Ethics', Prentice Hall, New Mexico, 2012.
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2013.
3. Edmund G Seebauer and Robert L Barry, 'Fundamentals of Ethics for Scientists and Engineers', Oxford University Press, 2013.
4. David Erman & Michele Shauf, 'Computers, Ethics and Society, Oxford University Press, 2012.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1						3			3		3	3				
CO2						3			2		2	2				
CO3											1					
CO4								1				1				
CO5											2					
CO6									3	1	2	1				

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191BAEE INTELLECTUAL PROPERTY RIGHTS

L	T	P	C
3	0	0	3

Programme: B.E. / B.Tech **Sem:** -- **Category:** OE

Aim: To provide an idea about IPR, registration and its enforcement.

Course Outcomes: The students will be able to

CO1: Make use of the Intellectual property rights in professional society.(UN)

CO2: Identify the process that shapes the registration of various categories of Intellectual Property Rights.(AP)

CO3: Explain agreements, and legislations of act relating to IPR.(UN)

CO4: Identify digital products and respective legislations.(AP)

CO5: Develop the ability of individuals to recognize and enforcing the legislations.(AP)

CO6: Interpret an idea about IPR, registration and its enforcement.(UN)

INTRODUCTION **9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

REGISTRATION OF IPRs **9**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

AGREEMENTS AND LEGISLATIONS **9**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

DIGITAL PRODUCTS AND LAW **9**

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

ENFORCEMENT OF IPRs **9**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

Total Periods: 45

Text Books:

1. S.V. Satarkar, 'Intellectual Property Rights and Copy Rights', ESS Publications, New Delhi, 2002.
2. Vinod V. Sople, 'Managing Intellectual Property', PHI Learning Pvt. Ltd, 4th Edition, 2014.

References:

1. Deborah E. Bouchoux, 'Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets', Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli, 'Intellectual Property Rights: Unleashing the Knowledge Economy', McGraw Hill Education, 2011.
3. Derek Bosworth and Elizabeth Webster, 'The Management of Intellectual Property', Edward Elgar Publishing Ltd., 2013.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1						3		3			3	2				
CO2					1	2					2					
CO3						2		2				2				
CO4					2	2				1						
CO5											3					
CO6						2		1	2		2					

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191BAEF	WOMEN STUDIES AND WOMEN EMPOWERMENT	L	T	P	C
		3	0	0	3

Programme: B.E. / B.Tech **Sem:** -- **Category:** OE

Aim: To study the legal provisions for women and women's access to justice and also familiarize the students with the notion of gender and its operation in society.

Course Outcomes: The students will be able to

CO1: Make use of the laws related to women's, rights protection.(AP)

CO2: Organize the students to look at stereotypical representation of women in the media and equip them to critique them. (AP)

CO3: Illustrate the specific cultural contexts of women in India.(UN)

CO4: Explain the legal provisions for women and women's access to justice. (UN)

CO5: Illustrate with the notion of gender operation in society. (UN)

CO6: Explain work place related issues and discriminatory wages.(UN)

WOMEN'S STUDIES: AN INTRODUCTION **9**

Women's Studies -Definition, Scope and Controversies. Basic concepts of Women's Studies- Women's Studies perspectives- Gender: Perspectives-Gender sensitive approach- Gender and sex- Biological determinism- stereotyping- Socialization- Patriarchy- Devaluation- Marginalization- Silencing- Male Gaze- Power politics- Gynocriticism- Gender mainstreaming- Gender and work- Invisibility-Glass ceiling. Women's Studies in India.

LEGISLATION AND GENDER JUSTICE **9**

Women's rights as human rights, UN Conventions, Convention on the Elimination of all forms of Discrimination against Women (CEDAW), Millennium Development Goals (MDGs) - Women's Rights in the Indian Constitution, Fundamental Rights, Directive Principles- Protective legislation for women in the Indian constitution- Anti dowry, SITA, PNDT, and Prevention Sexual Harassment at Workplace (Visaka case), Domestic violence (Prevention) Act- Women's Rights to property, Uniform Civil Code, Property rights according to religions background Muslim, Christian.

FEMINIST THEORIES **9**

Early feminist thinkers- J.S Mill, Mary Wollstonecraft - Women's Movements before and during the world war.- Recent trends in feminist thinking- Masculinities, Eco-feminism, queer theory, transgender politics, Cyber feminism, Post-colonial - Different Schools of feminist through in the Indian contest- National and regional feminist thoughts.

GENDER AND MASS MEDIA **9**

Definition of gender, difference between sex and gender- Feminist terminology, stereotyping, patriarchy, silencing, margin alisation - Male Gaze, Feminist film criticism, thematic and semiotic analysis- Various forms of mass media. Print media, radio, visual, new media- internet, feminism and cyber space, texting, SMS and cell phone usage - Influence of media in society, patriarchy - in operation, use of feminist methods for - critiquing media representation, practice sessions.

WOMEN AND SOCIETY IN INDIA **9**

Women's position from Vedic times to the present, women participation in India's independence movement - Social construction of gender and gender roles – Socialisation - Women in family- Women in family- feminization of poverty, violence against women, empowerment measures - Women and environment- eco-feminist movements, women and globalization- women's labour, discriminatory wages, changing working conditions and work place related issues.

Total Periods: 45

Text Books:

1. Roberta Rosenberg, "Women's Studies: An Interdisciplinary Anthology", Peter Lang, 2001.
2. Jean Fox O'Barr, "Feminism in Action: Building Institutions and Community through Women's Studies", University of North Carolina Press, 1994.

References:

1. Jill Duerr Berrick, "Faces of Poverty: Portraits of Women and Children on Welfare", Oxford

University Press, 1997.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1						3		3				2				
CO2						3				3						
CO3						3						2				
CO4						3						2				
CO5						3			2			2				
CO6						3			2			2				

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MANDATORY COURSES

191MC01	DESIGN THINKING	L-T-P	C
		2-0-0	0
Programme:	B.E., / B. Tech (Common to all)	**Category:**	MC

Aim: To impart knowledge on design thinking process for understanding complex designs and to provide design skills to analyze design thinking issues and apply the tools and techniques of design.

Course Outcomes: Students will be able to

CO1. Demonstrate knowledge of design thinking process (UN)
CO2. Recall design thinking techniques to design relevant products/services (RM)
CO3. Apply human centered design (HCD) methodology for product or service design (AP)
CO4. Use ideation techniques for developing innovative products or services (AP)
CO5. Analyse the causes for the problems in the design of products or services (AN)
CO6. Perform the steps to gain practical knowledge of prototyping, testing and validation (AP)

OVERVIEW OF DESIGN THINKING PROCESS **6**

Introduction to design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking, Problem solving, understanding design thinking and its process model, Design thinking tools. Human-Centered Design (HCD) process - Empathize, Define, Ideate, Prototype and Test and Iterate or Empathize, Analyze, Solve and Test.

EMPATHIZE **6**

Design thinking phases, How to empathize, Role of empathy in design thinking, purpose of empathy maps, Things to be done prior to empathy mapping, creation of user personas, customer journey mapping, How might we questions

SOLVE / IDEATE **6**

Silent brainstorming, metaphors for ideation, CREATE and What-If tool for ideation, introduction to TRIZ, Inventive principles and their applications

ANALYZE / DEFINE **6**

Root cause analysis, conflict of interest, perspective analysis, big picture thinking through system operator, big picture thinking through function modeling.

TEST (PROTOTYPING AND VALIDATION) **6**

Prototyping, Assumptions during the design thinking process, Validation in the market, best practices of presentation.

Total Periods 30

References

1. Dr. Bala Ramadurai, "Karmic Design Thinking", First Edition,TRIZ Innovation India, 2020.
2. Karl T. Ulrich, “Design Creation of Artifacts in Society”, Trustees of the University of Pennsylvania Publisher, USA, 2011
3. Alma R. Hoffmann, “Sketching as Design Thinking”, Taylor & Francis, UK, 2019
4. Michael Lewrick, Patrick Link and Larry Leifer, “The Design Thinking Playbook”, Wiley,USA,2018.

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1					1				1	2				
CO2		1		1							2	1				
CO3	1			1							2	1				
CO4	1	2		1							2	1				
CO5	1	2		2							2	1				
CO6	1						1				1	1				

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191MC02	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L-T-P	C
		2-0-0	0

Programme: B.E., / B. Tech (Common to All Branches) **Category:** MC

Aim: To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.

Course Outcomes: Students will be able to

CO1. Identify the concept of Traditional knowledge and its importance (AP)
CO2. Explain the need and importance of protecting traditional knowledge (UN)
CO3. Illustrate the various enactments related to the protection of traditional knowledge (UN)
CO4. Interpret the concepts of Intellectual property to protect the traditional knowledge (UN)
CO5. Identify the importance of conservation and sustainable development of environment (AP)
CO6. Explain the importance of Traditional knowledge in Agriculture and Medicine (UN)

INTRODUCTION TO TRADITIONAL KNOWLEDGE **6**

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

PROTECTION OF TRADITIONAL KNOWLEDGE **6**

The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

LEGAL FRAME WORK AND TRADITIONAL KNOWLEDGE **6**

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act);
The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003.

TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY **6**

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS **6**

Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

Total Periods 30

References

1. Amit Jha, “Traditional Knowledge System in India”, 2009.
2. Basanta Kumar Mohanta, Vipin Kumar Singh, “Traditional Knowledge System and Technology in India”, Pratibha Prakashan 2012.
3. Amit Jha, “Traditional Knowledge System in India”, Atlantic publishers, 2002
4. Kapil Kapoor, Michel Danino, "Knowledge Traditions anSd Practices of India"

E-Resources:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1										1		1				
CO2										1		1				
CO3										1		1				
CO4										1		1				
CO5										1		1				
CO6										1		1				

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191MC03	INDIAN CONSTITUTION	L-T-P	C
		2-0-0	0
Programme:	B.E., / B. Tech (Common to All Branches)	**Category:**	**MC**

Aim: To understand the importance of Indian constitution, Administration, Concept and Development of Human Rights, election commission.

Course Outcomes: Students will be able to

CO1. Know the sources, features and principles of Indian Constitution (UN)
CO2. Learn about Union Government and its administration (UN)
CO3. Learn about State government and its administration (UN)
CO4. Get acquainted with Local administration and Panchayat Raj (UN)
CO5. Be aware of basic concepts and developments of Human Rights (UN)
CO6. Gain knowledge on roles and functioning of Election Commission (UN)

INTRODUCTION TO INDIAN CONSTITUTION **6**

Constitution' meaning of the term, Indian Constitution- Sources and constitutional history, Features- Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNION GOVERNMENT AND STATE GOVERNMENT **6**

Union Government and its Administration Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

State Government and its Administration

Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions

LOCAL ADMINISTRATION AND PACHAYAT RAJ **6**

Local Administration District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation,

Panchayat raj: Introduction, PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

CONCEPT AND DEVELOPMENT OF HUMAN RIGHTS **6**

Meaning Scope and Development of Human Rights, United Nations and Human Rights – UNHCR, UDHR 1948, ICCPR 1996 and ICESCR 1966, Human Rights in India: Protection of Human Rights Act, 1993 - (NHRC and SHRC), First, Second and Third Generation Human Rights, Judicial Activism and Human Rights.

ELECTION COMMISSION **6**

Election Commission- Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women

Total Periods 30

References

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd. New Delhi
2. SubashKashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4E, 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government and Politics Hans
7. J. Raj Indian Government and Politics
8. M.V. Pylee, Indian Constitution
9. Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd. New Delhi
10. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E-Resources:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1						2				2		3				
CO2						2				3		3				
CO3						2				3		3				
CO4						2				3		3				
CO5						2				4		3				
CO6						2				3		3				

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191MC04	UNIVERSAL HUMAN VALUES	L-T-P	C
		2-0-0	0

Programme: B.E., / B. Tech (Common to All Branches) **Category:** MC

Aim: To facilitate the competence to understand the harmony in nature/existence and participation of human being in the nature/existence.

Course Outcomes: Students will be able to

CO1. Ensure the clarity about human aspirations, goal, activities and purpose of life (UN)
CO2. Develop the understanding of human tradition and its various components (UN)
CO3. Critically evaluate their preconditioning and present beliefs (UN)
CO4. Begin with, and then to continue within the student leading to continuous self- evolution (UN)
CO5. Verify the truth or reality in their own right, based on their Natural Acceptance and subsequent Experiential Validation (UN)
CO6. Set do's and don'ts related to values (UN)

INTRODUCTION **6**

The basic human aspirations and their fulfillment through Right understanding and Resolution; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution.

UNDERSTANDING HUMAN BEING AND ITS EXPANSION **6**

The domain of right understanding starts from understanding the human being (the knower, the experience and the doer); and extends up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).

ACTIVITIES OF THE SELF **6**

Understanding the human being comprehensively is the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Reasons for harmony/contradiction in the self.

UNDERSTANDING CO-EXISTENCE WITH OTHER ORDERS **6**

The need and the process of inner evolution (through self-exploration, self-awareness and self-evaluation)- particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).

EXPANSION OF HARMONY FROM SELF TO ENTIRE EXISTENCE **6**

Understanding different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavour viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from self to Nature and entire Existence.

Total Periods 30

References

1. A Foundation Course in Human Values and Profession Ethics (Text Book and Teachers' Manual), R. R. Gaur, R. Sangal, G. P. Bagaria (2010), Excel Books, New Delhi [ISBN 978-8- 174-46781-2]
2. Avartansheel Arthshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India
3. Economy of Permanence – (a quest for social order based on non-violence), J. C. Kumarappa (2010), Sarva-Seva-Sangh-Prakashan, Varansi, India
4. Energy and Equity, Ivan Illich (1974), The Trinity Press, Worcester & Harper Collins, USA
5. Ishandi Nau Upnishad, Shankaracharya, Geeta press, Gorakhpur,
6. Manav Vyavahar Darshan, A. Nagraj, Divya Path Sansthan, Amarkantak, India
7. Manaviya Sanvidhan, A. Nagraj, Divya Path Sansthan, Amarkantak, India

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1						2		2		2		3				
CO2						2		2		3		3				
CO3						2		1		3		3				
CO4						2		2		3		3				
CO5						2		2		4		3				
CO6						2		2		3		3				

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

191MC05	YOGA	L-T-P	C
		2-0-0	0
Programme:	B.E., / B. Tech (Common to All Branches)	**Category:**	**MC**

Aim: To promote positive health, prevention of stress related health problems and rehabilitation through Yoga.

Course Outcomes: Students will be able to

CO1. Know about the history and evolution of Yoga (UN)
CO2. Practice skills in Yoga for health (UN)
CO3. Find out the habits to ensure mental and emotional balance (UN)
CO4. Demonstrate basic skills associated with yoga activities including strength and flexibility, balance and coordination (UN)
CO5. Demonstrate the ability to perform yoga movements in various combination and forms (UN)
CO6. Demonstrate the ability to create and present various yoga sequences (UN)

FOUNDATIONS OF YOGA **5**

Origin of Yoga, History and Development of Yoga; Etymology and Definitions, Misconceptions, Aim and Objectives of Yoga, True Nature and Principles of Yoga.

YOUTH AND YOGA **5**

Youth and yoga- yoga as a tool for healthy lifestyle, Yoga as a preventive, promotive and curative method. Pranayama and Different Yoga traditions and their impacts.

ROLE OF YOGA IN PREVENTIVE HEALTH CARE **5**

Role of Yoga in preventive health care – Yoga as a way of life, Heyam dukham anagatam; Potential causes of Ill-health: Tapatrayas and Kleshas, Physical and Physiological manifestation of Disease: Vyadhi, Alasya, Angamejayatva and Ssvasa-prashvasa.

METHODS OF TEACHING YOGA **5**

Teaching and Learning: Concepts and Relationship between the two; Principles of Teaching: Levels and Phases of Teaching, Quality of perfect Yoga Guru; Yogic levels of learning, Vidyarthi, Shishya, Mumukshu; Meaning and scope of Teaching methods, and factors influencing them; Sources of Teaching methods;

ASAN AND PRANAYAM **10**

Asan and Pranayam:

- Various yoga poses and their benefits for mind & body
- Regularization of breathing techniques and its effects
- Different Phases in Pranayama Pracice:
  - Puraka (Inhalation), Kumbhaka (Retension) and Recaka (Exhalation)
  - Breathing Ratio in Pranayama Practice
  - Application of Bandhas in Pranayama

Total Periods 30

References

1. Yogic Asanas for Group Tarining-Part-I", Janardan Swami Yogabhyasi Mandal, Nagpur.
2. Swami Vivekananda, "Rajayoga or conquering the Internal Nature" AdvaitaAshrama Publication, Kolkata.

3. Silva Mehta, Mira Mehta and Shyam Mehta, "Yoga: The Iyengar Way", Knopp publication, 1990.
4. Vishnu-Devananda, "The Complete Illustrated Book of Yoga", 1995.
5. Timothy McCall, "Yoga as Medicine: The Yogic Prescription for Health and Healing", Harmony, 2007.
6. Hathayoga Pradipika of Swatmarama - Kaivalyadhama, Lonavala
7. The Science of Yoga - Taimini - Theosophical Publishing House, Adyar, Madras

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1												3				
CO2												3				
CO3												3				
CO4												3				
CO5												3				
CO6												3				

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)