SRI VENKATESWARA COLLEGE OF ENGINEERING,

(An Autonomous Institution, Affiliated to Anna University, Chennai – 600025)

B.E., Electronics and Communication Engineering

CURRICULUM AND SYLLABUS

REGULATION – 2022

CHOICE BASED CREDIT SYSTEM

Curriculum Revision No:	00	Board of Studies recommendation date :	12.09.2023 10.04.2023 07.10.2022 18.03.2022	Academic Council Approved date:	18.10.2023 21.04.2023 08.10.2022 12.04.2022	
Salient Points of the revision	01.	The courses "Tamil language and Heritage of Ancient Tamil Society" in Semester I and "Science and Technology in Ancient Tamil Society" in Semester II are introduced as per the recommendations of Anna University/Government of Tamil Nadu.				
	02.	The course “Technical Drawing Laboratory” is introduced in semester II replacing “Engineering Drawing” of R2018. This will enable the students to draw the circuit symbols using free hand sketches and simulation tools.				
	03.	The course “Circuit Theory” is shifted to semester II from semester III of R2018 and introduced as Theory cum Practical Course.				
	04.	The courses of R2018 “Engineering Mathematics III” and “Probability and Random Processes” are replaced with the new course “Transforms and Random Processes” and the same is offered in semester IV.				
	05.	The course “Environmental Sciences and Sustainability” is shifted to IV semester. This will help the Lateral entry students to describe the sustainable development for environmental protection.				
	06.	The course “Machine Learning” is introduced in semester IV as Theory cum Practical course. This will enable the students to expose the various Machine Learning algorithms and implementation of the same using Python.				
	07.	The course “Microcontroller Systems” is introduced as Theory cum Practical course in semester IV.				

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REGULATIONS 2022

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

CHOICE BASED CREDIT SYSTEM

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

I. Create value to organizations as an EMPLOYEE at various levels, by improving the systems and processes using appropriate methods and tools learnt from the programme.

II. Run an organization successfully with good social responsibility as an ENTREPRENEUR, making use of the knowledge and skills acquired from the programme.

III. Contribute to the future by fostering research in the chosen area as an ERUDITE SCHOLAR, based on the motivation derived from the programme.

PROGRAM OUTCOMES (POs)

PO	GRADUATE ATTRIBUTES
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 analyse 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 modelling 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.

PROGRAM SPECIFIC OUTCOMES (PSOs)

13. An ability to apply the concepts of Electronics, Communications, Signal processing, VLSI, Control systems etc., in the design and implementation of application oriented engineering systems.
14. An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical and managerial skills to arrive appropriate solutions, either independently or in team.

PEO's – PO's & PSO's MAPPING:

POs	PEOs		
	I	II	III
1.	✓		
2.	✓		✓
3.	✓	✓	
4.	✓		✓
5.	✓		
6.		✓	✓
7.		✓	
8.		✓	
9.	✓		✓
10.		✓	
11.		✓	
12.	✓		✓
13.	✓		✓
14.	✓	✓	

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REGULATIONS 2022

CHOICE BASED CREDIT SYSTEM

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM AND SYLLABI FROM SEMESTER I TO IV

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL Hours	Prerequisite	Position
				L	T	P	C			
1.	IP22151	Induction Programme (Common to all Branches)		-	-	-	-	-	-	-
Theory Subjects										
2.	HS22151	Tamil language and Heritage of Ancient Tamil Society (Common to all branches)	HS	1	0	0	1	1	Nil	F
3.	HS22152	Communicative English (Common to all Branches)	HS	3	0	0	3	3	Nil	F
4.	MA22151	Applied Mathematics I (Common to all Branches except MR)	BS	3	1	0	4	4	Nil	F
5.	PH22151	Applied Physics (Common to AD, CS, EE, EC, IT)	BS	3	0	0	3	3	Nil	F
6.	CY22151	Applied Chemistry (Common to AD, CS, EE, EC, IT)	BS	3	0	0	3	3	Nil	F
7.	EE22152	Basic Electrical Engineering	ES	3	0	0	3	3	Nil	F
8.	IT22101	Programming for Problem Solving (Common to IT, AD, CS, EE, EC)	ES	3	0	0	3	3	Nil	F
Practical Subjects										
9.	PH22161	Physics Laboratory (Common to all Branches except BT)	BS	0	0	2	1	2	Nil	F
10.	ME22161	Basic Civil and Mechanical Engineering Laboratory (Common to CE, EE, EC)	ES	0	0	2	1	2	Nil	F
11.	IT22111	Programming for Problem Solving Laboratory (Common to IT, AD, CS, EE, EC)	ES	0	0	3	1.5	3	Nil	F
			Total	**19**	**1**	**7**	**23.5**	**27**	-	-

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL Hours	Prerequisite	Position
				L	T	P	C			
Theory Subjects										
1.	HS22251	Science and Technology in Ancient Tamil Society (Common to all Branches)	HS	2	0	0	2	2	Nil	F
2.	HS22252	Technical English (Common to all Branches)	HS	3	0	0	3	3	Nil	F
3.	MA22251	Applied Mathematics II (Common to all Branches except MR)	BS	3	1	0	4	4	Nil	F
4.	PH22252	Physics of Materials (Common to EE and EC)	BS	3	0	0	3	3	Nil	F
5.	EC22201	Electron Devices	PC	3	0	0	3	3	Nil	F
6.	EC22202	Circuit Theory	PC	3	0	2	4	5	EE22152	F
Practical Subjects										
7.	CY22161	Chemistry Laboratory (Common to all Branches except AD, CS, IT)	BS	0	0	2	1	2	Nil	F
8.	EC22211	Technical Drawing Laboratory	ES	0	0	2	1	2	Nil	F
9.	EC22212	Electron Devices and Electrical Machines Laboratory	PC	0	0	3	1.5	3	Nil	F
			Total	**17**	**1**	**9**	**22.5**	**27**	-	-

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL Hours	Prerequisite	Position
				L	T	P	C			
Theory Subjects										
1.	MA22358	Transforms and Random Processes	BS	3	1	0	4	4	Nil	F
2.	EC22301	Object Oriented Programming and Data Structures	ES	3	0	0	3	3	Nil	F
3.	EC22302	Digital System Design	PC	3	0	0	3	3	PH22151	F
4.	EC22303	Electromagnetic Fields and Waves	PC	3	0	0	3	3	Nil	F
5.	EC22304	Electronic Circuits	PC	3	0	0	3	3	EC22201, EC22202	F
6.	EC22305	Signals and Systems	PC	3	0	0	3	3	Nil	F
Practical Subjects										
7.	EC22311	Analog and Digital Circuits Laboratory	PC	0	0	3	1.5	3	Nil	F
8.	EC22312	Object Oriented Programming and Data Structures Laboratory	ES	0	0	3	1.5	3	Nil	F
			Total	**18**	**1**	**6**	**22**	**25**	-	-

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL Hours	Prerequisite	Position
				L	T	P	C			
Theory Subjects										
1.	EC22401	Analog Integrated Circuits and its Applications	PC	3	0	0	3	3	EC22304	F
2.	EC22402	Linear Control Systems	PC	3	0	0	3	3	Nil	F
3.	EC22408	Machine Learning: Theory and Practices	ES	3	0	2	4	5	Nil	F
4.	EC22409	Microcontroller Systems: Theory and Practices	PC	3	0	2	4	5	Nil	F
5.	EC22403	Discrete Time Signal Processing	PC	3	0	0	3	3	EC22305	F
6.	GE22451	Environmental Sciences and Sustainability (Common to all branches)	HS	3	0	0	3	3	Nil	F
Practical Subjects										
7.	EC22411	Analog Integrated Circuits and Simulation Laboratory	PC	0	0	3	1.5	3	Nil	F
8.	EC22412	Discrete Time Signal Processing Laboratory	PC	0	0	3	1.5	3	Nil	F
			Total	**18**	**0**	**10**	**23**	**28**	-	-

SEMESTER I

HS22151	தமிழ் மொழியும் தமிழர் மரபும் TAMIL LANGUAGE AND HERITAGE OF TAMILS (Common to all branches)	L	T	P	C
		1	0	0	1

பாடத்தின் நோக்கங்கள்:

1. தமிழ் மொழியின் தோற்றம் பற்றியும், திணை கருத்துக்கள் வாயிலாக வாழ்வியல் முறைகளை பற்றியும் கற்றுக் கொள்வார்கள்.
2. இந்திய தேசிய சுதந்திர இயக்கத்தில் தமிழர்களின் பங்களிப்பு மற்றும் தமிழர்களின் மேலாண்மை முறைகளை பற்றியும் கற்றுக் கொள்வார்கள்.

Course Objectives :

1. They will learn about the origin of the Tamil language and the ways of life through five types of lands.
2. They will also learn about the contribution of Tamils in the Indian National Freedom Movement and the management methods of Tamils.

அலகு 1	**தமிழுக்கும் தொழில்நுட்பக் கல்விக்கும் உள்ள தொடர்பு**	**3**

மொழி மற்றும் பாரம்பரியம்: இந்தியாவில் உள்ள மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழில் செம்மொழி இலக்கியம் - உ.வே.. சாமிநாதய்யர். ஆறுமுகநாவலர் ஆகியோரின் பங்களிப்பு – தொழில் நுட்பக் கல்வியில் தமிழ் மொழியின் முக்கியத்துவம்.

UNIT -1 LANGUAGE AND HERITAGE

Language families in India – Dravidan Languages – Tamil as a Classical language – Classical Literature in Tamil – Contribution of U. Ve. Saminathaiyar. Arumuka Navalar – Importance of Tamil language in technical education.

அலகு 2	**திணை கருத்துக்கள்**	**9**

திணை கருத்துக்கள்: -ஐந்து வகை நிலங்கள், விலங்குகள், கடவுள்கள், தொழில், வாழ்க்கை முறைகள், இசை, நடனம், உணவு முறை, தமிழர்களின் தாவரங்கள் மற்றும் விலங்கினங்கள் – தொல்காப்பியம் மற்றும் சங்க இலக்கியங்களில் இருந்து அகம் மற்றும் புரம் கருத்து – தமிழ் பற்றிய அறம் கருத்து – கல்வி மற்றும் எழுத்தறிவு சங்க காலம் – சங்ககாலத்தின் பண்டைய நகரங்கள் மற்றும் துறைமுகங்கள் – சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – சோழர்களின் வெளிநாட்டு வெற்றி.

UNIT -2 THINAI CONCEPTS

Five types of lands, animals, Gods, occupation, life styles, music, dance , food style, Floara and Fauna of Tamils - Agam and puram concept from Tholkappiyam and Sangam Literature – Aram concept of Tamil – Education and Literacy during Sangam Age – Ancient cities and Ports of Sangam Age – Export and Import during Sangam Age - Overseas Conquest of Choloas.

அலகு 3	**தமிழரின் மரபு**	**3**

இந்திய தேசிய சுதந்திர இயக்கம் மற்றும் இந்திய கலாச்சாரத்திற்கு தமிழர்களின் பங்களிப்பு:- சுப்ரமணிய பாரதி, வாஞ்சிநாதன், சுப்பிரமணிய சிவா, வீரபாண்டிய கட்ட பொம்மன், வா..ஊ சிதம்பரம் பிள்ளை, தீரன் சின்னமலை, மருது பாண்டிய சகோதரர்கள், பூலி தேவர், திருப்பூர் குமரன், வீரமங்கை வேலு நாச்சியார் - ,தமிழர் இலக்கியங்களில் மேலாண்மை கருத்துக்கள் (கி. மு. 500 முதல் கி. பி 200 வரை) – அகநானூறு, புறநானூறு, திருக்குறள் ஆகியவற்றில் மேலாண்மைக் கருத்துகள்..

UNIT -3 HERITAGE OF TAMILS

Contribution of Tamils to Indian National Freedom Movement and Indian Culture : Contributions of Subramanya Bharathi, Vanchinathan, Subramaniya Siva, Veerapandiya Kattabomman, V O Chidambaram Pillai, Dheeran Chinnamalai, The Maruthu Pandiyar, Puli Thevar, Tiruppur Kumaran, Veera Mangai Velunachiyar.

பாடநூல்கள்:

1. **பொன். முத்துகுமாரன்** (2002), "தமிழ் மரபு", காந்தளகம், 68, அண்ணா சாலை, சென்னை 600 002
2. **பி. டிஶ்ரீனிவாச ஐயங்கார்** (தமிழக்கமும் திறனாய்வும்) புலவர் கா. கோவிந்தன் (1988), "தமிழர் வரலாறு (முதல் பகுதி)", திருநெல்வேலி தென்னிந்திய சைவ சித்தாந்த நூற்பதிப்பு கழகம் ,154, TTK சாலை, சென்னை 18.
3. **டாக்டர். கே. கே. பிள்ளை** (2009), "தமிழக வரலாறு மக்களும் பண்பாடும்", உலக தமிழாராய்ச்சி நிறுவனம், தரமணி , சென்னை 600113
4. **முனைவர். ச. இராஜேந்திரன்** (2004), "தமிழில் சொல்லாக்கம்", தஞ்சாவூர் தமிழ் பல்கலைக் கழகம் வெளியீடு

பாடநெறி முடிவுகள் : படிப்பை வெற்றிகரமாக முடித்தவுடன் , மாணவர்கள் பின்வருவனவற்றைச் செய்ய முடியும்.

COURSE OUTCOMES : On completion of the course, the student will be able to

பா .வெ . எண் **CO No**	பாடத்திட்டத்தின் வெளிப்பாடு **Course Outcomes**	**RBT* level**
1	மாணவர்கள் தமிழ் மொழித் தோற்றம் பற்றித் தெரிந்து கொள்வார்கள். Students will learn about the origin of the Tamil language	1
2	தமிழர்களின் வாழ்வியல் முறைகளைத் தெரிந்து கொள்வார்கள். They will know the ways of life of Tamils.	2
3	தமிழர்களின் சுதந்திர போராட்ட வீரர்களை பற்றியும், மேலாண்மைகளை பற்றியும் தெரிந்து கொள்வார்கள். They will know about the freedom fighters of Tamils and the management of Tamils	2
1- Weak; 2 - Moderate; 3 - Strong.		

HS22152	COMMUNICATIVE ENGLISH (Common to all Branches)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. Enable learners to interact fluently on everyday social contexts.
2. Train learners to engage in conversations in an academic/scholarly setting.
3. Instil confidence in learners to overcome public speaking barriers.
4. Develop learners' ability to take notes and in the process, improve their listening skills
5. Enhance learners' reading skill through reading text passages for comprehension and contemplation.
6. Improve learners' skills to write on topics of general interest and drafting correspondences for general purposes.

UNIT 1		**9**

Listening - short video clips - conversational scenes form movies, celebrities' speeches /interviews. Speaking - several ways of introducing oneself at several situations, introducing others at several situations, inviting people for several occasions, describing people and their places. Reading - short comprehension passages - making inferences, critical analysis. Writing - completing the incomplete sentences - developing hints from the given information. Grammar - Wh-Questions and Yes or No questions - Parts of speech. Vocabulary development - prefixes - suffixes - articles - countable / uncountable nouns.

UNIT II		**9**

Listening - customer care voice files, short narratives - identifying problems and developing telephone etiquettes. Speaking - speaking over skype/ whatsapp, making business calls, making self-recorded informative videos, inquiring about a concept/activity, describing a concept/activity. Reading - reading the headlines on news magazines - slogans and taglines from advertisements. Writing - free writing - writing - headlines, slogans and taglines individual inspirations. Grammar- conjunctions, idioms, phrases, quotes. Vocabulary development - guessing the meanings of words in different contexts.

UNIT III		**9**

Listening - courtroom scenes from movies, debates and talks from news channels, notes taking. Speaking - language and tone for arguments, discussion, deliberation, contemplation, expressing opinions, reacting to different situations in an alien country. Reading - language used in instruction manuals of household appliances, cookery and other basic instructions. Writing- understanding the structure of texts - use of reference words, discourse markers- coherence, rearranging the jumbled sentences. Grammar - adjectives - degrees of comparison, framing direct and indirect questions. Vocabulary development - concise approach, single word substitution.

UNIT IV		**9**

Listening - Sports commentaries, advertisements with users' criticisms; Speaking - for social causes, for promoting a concept, negotiating and bargaining; Reading - review of a product, movie, movement or a system; Writing - writing for advertisements, selling a product; Grammar – Tenses - Simple Past, Present and Future, Continuous - Past, Present and Future; Vocabulary Development - synonyms, antonyms and phrasal verbs.

UNIT V		**9**

Listening - video lectures, video demonstration of a concept; Speaking – presenting papers/concepts, delivering short speeches, discourses on health, suggesting natural home remedies, cleanliness, civic sense and responsibilities; Reading - columns and articles on home science; Writing - correspondences of requests, basic enquiry/observation and basic complaints; Grammar - modal verbs, perfect tenses - Vocabulary development - collocations.

TOTAL: 45 PERIODS

REFERENCES:

1. Department of English, Anna University, Mindscapes : English for Technologists and Engineers. Orient Black Swan, Chennai, 2017.
2. Downes and Colm, "Cambridge English for Job-hunting", Cambridge University Press, New Delhi, 2008.
3. Murphy and Raymond, "Intermediate English Grammar with Answers", Cambridge University Press, 2000.
4. Thomson, A.J., "Practical English Grammar" Oxford, 1986.

Websites

1. http://www.usingenglish.com
2. http://www.uefap.com3
3. https://owl.english.purdue.edu/owl/
4. www.learnenglishfeelgood.com/esl-printables-worksheets.html

Software

1. Face 2 Face Advance – Cambridge University Press, 2014.
2. English Advance Vocabulary- Cambridge University Press.
3. IELTS test preparation – Cambridge University Press 2017.
4. Official Guide to the TOEFL Test With CD-ROM, 4th Edition.
5. Cambridge Preparation for the TOEFL TEST- Cambridge University Press, 2017.

Course Outcomes: Upon completion of the course, students will be able to:		**RBT* Level**
CO1	Acquire adequate vocabulary for effective communication	3
CO2	Listen to formal and informal communication and read articles and infer meanings from specific contexts from magazines and news papers.	3
CO3	Participate effectively in informal/casual conversations; introduce themselves and their friends and express opinions in English.	4
CO4	Comprehend conversations and short talks delivered in English.	6
CO5	Write short write-ups and personal letters and emails in English	6

***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	-	-	-	-	-	-	-	-	-	3	-	-	-	-
2.	-	-	-	-	-	-	-	-	-	3	-	-	-	-
3.	-	-	-	-	-	-	-	-	-	3	-	-	-	-
4.	-	-	-	-	-	-	-	-	-	3	-	-	-	-
5.	-	-	-	-	-	-	-	-	-	3	-	-	-	-
1- Weak; 2 - Moderate; 3 - Strong.														

MA22151	APPLIED MATHEMATICS I (Common to all Branches except MR)	L 3	T 1	P 0	C 4

COURSE OBJECTIVES:

The Student should be made to:

1. Compute eigen values and eigen vectors and use in diagonalization and in classifying real quadratic forms.
2. Study differential calculus and its applications to relevant Engineering problems.
3. Compute derivatives using the chain rule or total differentials.
4. Understand the rotation of two dimensional geometry using definite integrals.
5. Acquaint with the Mathematical tools needed in evaluating multiple integrals and their usage.

UNIT 1	MATRICES	(9+3)

Eigen values and Eigen vectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigen vectors – Statement and Applications of Cayley-Hamilton Theorem – Diagonalization of matrices– Reduction of a quadratic form into canonical form by orthogonal transformation-Nature of quadratic forms.

UNIT II	APPLICATION OF DIFFERENTIAL CALCULUS	(9+3)

Curvature and radius of Curvature– Centre curvature – Circle of curvature –Evolutes– Envelopes-Evolute as Envelope of Normals.

UNIT III	DIFFERENTIAL CALCULUS FOR SEVERAL VARIABLES	(9+3)

Limits and Continuity - Partial derivatives – Total derivatives – Differentiation of implicit functions – Jacobians and properties– Taylor's series for functions of two variables – Maxima and Minima of functions of two variables –Lagrange's method of undetermined multipliers.

UNIT IV	APPLICATION OF DEFINTE INTEGRALS	(9+3)

Integration by Parts-Bernoulli's formula for integration- Definite integrals and its Properties- Solids of Revolution- Disk Method- Washer Method- Rotation about both x and y axis and Shell method.

UNIT V	MULTIPLE INTEGRALS	(9+3)

Double integrals in Cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves - Change of variables in double integrals – Triple integrals – Volume of solids.

TOTAL (L: 45 + T:15): 60 PERIODS

TEXT BOOKS:

1. Erwin Kreyszing, Herbert Kreyszing, Edward Norminton, "Advanced Engineering Mathematics", 10th Edition, John Wiley, (2015)
2. Grewal .B.S, Grewal .J.S "Higher Engineering Mathematics",43rd Edition, Khanna Publications, Delhi, (2015).

REFERENCES:

1. Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", Nineth Edition, Laxmi Publications Pvt. Ltd., (2014).
2. Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, (2016).
3. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2013).

Web Link:

1. https://home.iitk.ac.in/~peeyush/102A/Lecture-notes.pdf
2. https://www.sydney.edu.au/content/dam/students/documents/mathematics-learning-centre/integration-definite-integral.pdf

Course Outcomes: Upon completion of the course, students will be able to:		**RBT* Level**
CO1	Solve the Eigen value problems in matrices.	3
CO2	Apply the basic notion of calculus in Engineering problems and to tackle for different geometries.	3
CO3	Perform calculus for more than one variable and its applications in Engineering problems.	3
CO4	Apply definite integrals for design of three dimensional components.	3
CO5	Evaluate multiple integral in Cartesian and polar coordinates.	3
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO-1**	**PSO-2**
CO1	3	3	3	3	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	3	-	-
1- Weak; 2 - Moderate; 3 - Strong.														

PH22151	APPLIED PHYSICS (Common to AD, CS, EE, EC, IT)	L 3	T 0	P 0	C 3

COURSE OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various Streams of Engineering and Technology.

UNIT 1	**LASERS AND FIBER OPTICS**	**9**

Lasers: population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Nd-YAG laser – CO_2 Laser – Exceimer Laser – Applications. Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, and mode) – losses associated with optical fibers–Fiber optic communication - fibre optic sensors: pressure and displacement - Endoscope.

UNIT 2	**QUANTUM PHYSICS**	**9**

Black body radiation – Planck's theory (derivation)- deduction of Wien's and Rayleigh Jean's law – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent wave equations – particle in a one-dimensional - three dimensional potential box–Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT 3	**CRYSTAL PHYSICS**	**9**

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – interplanar distances- coordination number and packing factor for SC, BCC, FCC, HCP and Diamond structure (qualitative) - crystal imperfections: point defects, line defects – Burger vectors, stacking faults

UNIT 4	**WAVES AND OSCILLATIONS**	**9**

Travelling waves, Wave equation for string ,Energy and momentum , Resonance Superposition & Reflection, Standing waves, Harmonic oscillations, Damped harmonic motion- Forced oscillations, amplitude resonance - Expression for Resonant frequency, Electrical analogy of mechanical oscillations, Quality factor and sharpness of resonance, Electrical analogy of mechanical oscillators

UNIT 5	**ELECTROMAGNETIC WAVES**	**9**

Maxwell's Equations. Vector and Scalar Potentials. Plane waves in Dielectric media. Poynting Theorem and Poynting Vector.- Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density, EM Wave Propagation in Unbounded Media , Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant.

Total (L:45): 45 PERIODS

TEXT BOOKS:

1. Gaur R.K., Gupta S.L, "Engineering Physics", Dhanput Publications, 2015.
2. Shatendra Sharma, Jyotsna Sharma, "Engineering Physics", Pearson, 2006.
3. Rajendran V, "Engineering Physics", Tata McGraw Hill, 2009.
4. Arumugam M, "Materials Science", Anuradha Publications, 2015.

REFERENCES:

1. David Halliday, Robert Resnick, Jearl Walker, "Principles of Physics", 10th Edition, Wiley, 2015.
2. Peter Atkins, Julio De Paula, "Physical Chemistry",10th Edition., Oxford University Press, 2014.
3. Arthur Beiser, Shobhit Mahajan, Rai Choudhury S,"Concepts of Modern Physics", 7th Edition, McGraw Hill Education, 2017.
4. Raghavan V, "Materials Science and Engineering", PHI Learning Pvt. Ltd., 2010

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO 1	Develop an understanding about photonics and Fiber Optic communication system	2
CO 2	Acquire the knowledge of Quantum mechanics	3
CO 3	Classify and demonstrate the fundamentals of crystals and their defects.	3
CO 4	Gain knowledge in waves and oscillations	2
CO 5	Enable to explore the theory of electromagnetic waves and its propagation	3
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX:

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	-	-	-	2	2	-	-	-	1	-	-	-	-
2.	3	3	2	2	2	2	-	-	-	1	-	2	-	-
3.	3	-	-	-	-	-	-	-	-	1	-	-	-	-
4.	3	-	2	-	-	-	-	-	-	1	-	-	-	-
5.	3	3	2	2	2	-	-	-	-	1	-	2	-	-
1- Weak; 2 - Moderate; 3 - Strong.														

CY22151	APPLIED CHEMISTRY (Common to AD, CS, EE, EC, IT)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To make the students conversant with basic electrochemistry and batteries.
2. To develop an understanding of the laws of photochemistry and basics.
3. To acquaint the students with the basics of nanomaterials, their properties and uses.
4. To acquire the basic knowledge on sensors which are essential for the software engineers for develop new devices.
5. To enable the students to understand the types of instruments for material analysis and their working principle.

UNIT I	**ELECTROCHEMISTRY**	**9**

Electrodes and electrochemical cells – electrode potential, standard electrode potential, single electrode potential and its determination, types of electrodes – calomel, quinhydrone and glass electrode. Nernst equation - Determination of pH of a solution by using quinhydrone and glass electrode. Electrochemical series and its applications. Batteries – Primary (dry cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery) and next generation batteries

UNIT II	**PHOTOCHEMISTRY**	**9**

Laws of photochemistry – Grotthuss-Draper law, Stark–Einstein law and Lambert Beer Law – determination iron by spectrophotometer. Quantum efficiency – Photo processes - internal conversion, inter-system crossing, fluorescence, phosphorescence and photo-sensitization-quenching of fluorescence and its kinetics, Stern-Volmer relationship. Applications of photochemistry.

UNIT III	**NANOCHEMISTRY**	**9**

Basics and scale of nanotechnology, different classes of nanomaterials, Distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Synthesis of nanomaterials, fabrication (lithography) and its applications – Basics of nanophotonics and quantum confined materials (surface plasmon resonance).

UNIT IV	**CHEMICAL SENSOR**	**9**

Sensors, sensor science and technology, types of sensors. Chemical Sensors – characteristics and elements. Electrochemical sensors – voltammetry, potentiometric sensors, amperometric sensors, polarization techniques.

UNIT V	**INSTRUMENTATION TECHNIQUES**	**9**

Treatment of analytical data, including error analysis. Classification of analytical methods and the types of instrumental method - Electromagnetic radiation-UV-visible and IR spectroscopy: principles, instrumentation (Block diagram only) and applications. Separation techniques chromatography: Gas chromatography, liquid chromatography - importance of column technology (packing, capillaries), separation based on increasing number of factor (volatility, solubility, interactions with stationary phase, size)

TOTAL (L: 45): 45 PERIODS

TEXT BOOKS:

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010.
2. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
3. B.K.Sharma, "Instrumental Methods of Chemical Analysis", 28th Edition, Goel Publishing House, 2012.
4. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.

REFERENCES:

1. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.
2. B.R. Puri, L.R. Sharma, M.S. Pathania., "Principles of Physical Chemistry" Vishal Publishing Company, 2008.
3. John Vetelino, Aravind Reghu, Introduction to Sensors , Taylor & Francis Group, CRC Press, 1st edition, 2010.
4. Peter Gründler, Chemical Sensors, An Introduction for Scientists and Engineers, Springer-Verlag Berlin Heidelberg 2007.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Identify electrochemical cells, corrosion and fundamental aspects of batteries.	2
CO2	Interpret the photochemical reactions and make use of spectroscopic techniques.	2
CO3	Realize the structures, properties and applications of nanoparticles.	2
CO4	Acquire the basic knowledge on chemical sensors to develop an interdisciplinary approach among the students which are essential for the software engineers.	2
CO5	Develop theoretical principles of UV-visible and IR spectroscopy and separation techniques.	3

***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	3	2	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	-	3	3	-	-	-	-	3	-	-
CO3	3	3	3	-	-	3	3	1	-	-	-	3	-	-
CO4	3	3	3	-	1	3	3	-	-	-	-	3	-	-
CO5	3	3	-	2	-	3	3	-	-	-	-	3	-	-
1- Weak; 2 - Moderate; 3 - Strong.														

EE22152	BASIC ELECTRICAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce basics concepts of electric circuits
2. To impart knowledge in types, construction and working of DC machines and transformers.
3. To study the working principles of AC machines.
4. To introduce the components of low voltage electrical installations and working principles of Power converters.
5. To study the different types of measuring instruments.

UNIT I	**BASIC CIRCUITS ANALYSIS**	**9**

Ohm's Law – Kirchoff's laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits – Phasor Diagram – Power, Power Factor and Energy. Network reduction: Voltage and current division rule, Star to delta conversion.

UNIT II	**DC MACHINES AND TRANSFORMER**	**9**

Introduction- ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer. Construction, working, torque-speed characteristic and speed control of separately excited dc motor – Applications.

UNIT III	**AC MACHINES**	**9**

Overview of three phase circuits, Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip Characteristic, Loss components and efficiency, Single-phase induction motor, Working of synchronous generators.

UNIT IV	**ELECTRICAL INSTALLATIONS AND POWER CONVERTERS**	**9**

Components of LT switch gear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB. Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption. DC-DC buck and boost converters, duty ratio control. Introduction to voltage source inverters.

UNIT V	**MEASURING INSTRUMENTS**	**9**

Types of instruments, Construction and working principles of PMMC and moving iron type voltmeters, ammeters and ohm meter. Measurement of frequency. Single phase dynamometer wattmeter, Use of shunts and multipliers (Simple numerical problems on shunts and multipliers). Analog Energy meters, Smart digital Energy meter and Net meter.

TOTAL (L:45): 45 PERIODS

TEXT BOOKS:

1. D.P. Kothari and I.J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 3rd edition 2010.
2. D.C. Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2009.
3. E. Hughes, "Electrical and Electronics Technology", 10th Edition, Pearson, 2010.

REFERENCES:

1. Vincent Deltoro, "Electrical Engineering Fundamentals", Second Edition, Prentice Hall India, 1989.
2. S.K.Bhattacharya , "Basic Electrical and Electronics Engineering", Pearson India, 2011.
3. William Hayt and Jack E. Kemmerly, "Engineering circuit analysis", Mc Graw Hill Company, 6th edition, 2016.
4. Newnes Electrical Power Engineers handbook, II edition, Elsevier publications, 2005.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Analyze DC and AC electrical circuits using Kirchoff's law.	4
CO2	Explain the working principle of electrical machines	4
CO3	Choose the appropriate electrical machines for various applications.	4
CO4	Understand the principles of electrical machines and power converters.	4
CO5	Explain the types and operating principle of measuring instruments.	4
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX:

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	3	3	3	3	-	-	-	-	-	-	-	3	3
2.	3	3	-	-	-	-	-	-	-	-	-	-	3	3
3.	3	3	-	-	-	-	-	-	-	-	-	-	3	3
4.	3	2	-	-	-	-	-	-	-	-	-	-	3	2
5.	3	2	-	-	2	-	-	-	-	-	-	-	3	2
1- Weak; 2 - Moderate; 3 - Strong.														

IT22101	PROGRAMMING FOR PROBLEM SOLVING (Common to IT, AD, CS, EE, EC)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. Learn the organization of a digital computer.
2. Learn to think logically and write algorithms or draw flow charts for problems.
3. Be exposed to the syntax of C.
4. Be familiar with programming in C.
5. Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT 1	**INTRODUCTION TO PROBLEM SOLVING**	**6**

Simple model of a Computer – Hardware – Software – Data Representation, Introduction to Computer Networks and Internet, Problem Solving Techniques – Bottom up design and top down design - applications, Introduction to Algorithms and Flow Chart

Suggested Activities:

Casestudy – Understanding the analysis and design of the Student Management System (SMS).

UNIT 2	**C PROGRAMMING BASICS**	**12**

Introduction to 'C' programming – structure of a 'C' program – Conversion of simple algorithm to program. 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.

Suggested Activities

Casestudy: Dataset creation and Grade calculation in SMS

UNIT 3	**ARRAYS AND STRINGS**	**9**

Array: declaration, initialization. Multi dimensional arrays. Strings: Strings vs Character arrays, string operations

Suggested Activities - Grade sheet generation in SMS

UNIT 4	**FUNCTIONS AND STRUCTURES**	**9**

Need for Modular programming, Functions: definition, call, arguments, call by value. Call by reference, Recursion. structures and unions: Need, declaration, Accessing Structure elements, Arrays of structures

Suggested Activities: Redesigning SMS in terms of modules

UNIT 5	**POINTERS AND FILE HANDLING IN C**	**9**

Pointers: Introduction, pointers to primitive datatypes, pointers to user defined datatypes: arrays and structures, array of pointers, Dynamic Memory Allocation. Files: Read/Write of binary and text files. Preprocessor directives

Suggested Activities: Mange I/O in SMS using Files

TOTAL (L:45): 45 PERIODS

TEXT BOOKS:

1. Pradip Dey, Manas Ghosh, " Programming in C ", First Edition, Oxford University Press, 2018.
2. R G Dromey, "How to Solve it using Computer", Pearson,2006

REFERENCES:

1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, PearsonEducation, 2015.
2. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.
3. Byron S Gottfried, "Programming with C", Schaum's Outlines, Third Edition, Tata McGraw Hill, 2010
4. Reema Thareja, "Programming in C", 2nd ed., Oxford University Press, 2016

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Identify input and output from the real word problem scenarios.	3
CO2	Represent the design flow using Flow-charts and application logic using pseudo code.	3
CO3	Apply appropriate programming constructs to implement a given design using C.	3
CO4	Debug and customize an existing software developed in C.	5
CO5	Develop a modularised software application In C for the given user requirements	6
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX:

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	1	3	-	-	-	-	-	2	3	-	-	2	2	2
2.	1	3	-	-	-	-	-	2	3	-	-	2	2	2
3.	1	-	3	2	1	-	-	2	3	-	-	2	2	2
4.	1	-	3	2	1	-	-	2	3	-	-	2	2	2
5.	1	-	3	2	1	-	-	2	3	-	-	2	3	3
1- Weak; 2 - Moderate; 3 - Strong.														

PH22161	PHYSICS LABORATORY (Common to all Branches except BT)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS: (Any EIGHT Experiments)

1. a) Determination of Wavelength, and particle size using Laser.
   b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of Young's modulus by Non uniform bending method.
6. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.
7. Determination of Rigidity modulus of a given wire -Torsional Pendulum
8. **Energy band gap of a Semiconductor**
9. Determine the Hysteresis loss of a given Specimen
10. **Calibration of Voltmeter & Ammeter using potentiometer.**

Total (P:30): 30 PERIODS

REFERENCE:

1. "Physics Laboratory practical manual", 1st Revised Edition by Faculty members, 2018.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO 1	Analyze the physical principle involved in the various instruments; also relate the principle to new application.	4
CO 2	Comprehend the Experiments in the areas of optics, mechanics and thermal physics to nurture the concepts in all branches of Engineering.	3
CO 3	Apply the basic concepts of Physical Science to think innovatively and also improve the creative skills that are essential for engineering.	3
CO 4	Evaluate the process and outcomes of an experiment quantitatively and qualitatively	3
CO 5	Extend the scope of an investigation whether or not results come out as expected	3

***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	3	2	3	2	-	-	-	3	1	-	2	-	-
2.	3	3	-	3	-	2	-	-	3	1	-	2	-	-
3.	3	3	2	3	2	2	-	-	3	1	-	2	-	-
4.	3	3	-	3	-	-	-	-	3	1	-	2	-	-
5.	3	3	-	3	2	-	-	-	3	1	-	2	-	-

1- Weak; 2 - Moderate; 3 - Strong.

ME22161	BASIC CIVIL AND MECHANICAL ENGINEERING LABORATORY (Common to CE, EE, EC)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

1. To provide an exposure and hands on experience to the students on various civil and mechanical engineering processes.

LIST OF EXPERIMENTS

1- Carpentry – Preparation of Cross half lap joint and Tee joint using power tools.
2- Plumbing – Basic pipe line connection used in houses with PVC pipes, valves, taps, couplings, unions, reducers, elbows.
3- Welding - Butt joint and lap joint using Electric Arc welding.
4- Machining – Turning and facing using Centre Lathe.
5- Sheet metal work – Making of a cylinder using GI sheet and finishing using rivets.
6- Fitting – Preparation of metal pieces by grinding and filing to maintain flat sides at right angles
7- Drilling and Tapping – Drilling of holes precisely and making internal threads by Tapping for various sizes.
8- Casting – Mould preparation using simple solid pattern and casting.
9- Automation – Basic pneumatic circuit using single and double acting cylinder.
10- 3D printing –Demonstration of printing of simple solids using Additive Manufacturing/3D printing.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Jeyachandran K., Natarajan S. & Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
2. Jeyapoovan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Publishing House Pvt.Ltd, 2006.
3. Bawa H.S., "Workshop Practice", Tata McGraw Hill Publishing Company Limited, 2007.
4. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
5. Anthony Esposito, Fluid Power with Applications, Pearson Education, 7th edition, 2009.
6. Civil & Mechanical engineering practices lab manual, SVCE, 2022.

OUTCOMES:

CO	*CO statements*	RBT* level
CO1	Students will be able to ***Prepare*** various joints used for assembling wooden parts.	3
CO2	Students will be able to ***Make*** required pipeline connection by selecting the suitable components	3
CO3	Students will be able to ***Fabricate*** components by various manufacturing processes.	3
CO4	Students will be able to ***Understand*** the principles of low-cost automation using pneumatic circuits.	2
CO5	Students will be able to ***Understand*** the principle of additive manufacturing/3D printing	2

***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6

COURSE ARTICULATION MATRIX

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	-	-	-	2	-	-	-	-	-	-	-	-	-
CO5	1	-	-	-	2	-	-	-	-	-	-	-	-	-

1- Weak; 2 - Moderate; 3 - Strong.

IT22111	PROGRAMMING FOR PROBLEM SOLVING LABORATORY (Common to IT, AD, CS, EE, EC)	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

LIST OF EXERCISES

1. Usage of Basic Linux commands.
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 Strings.
6. C Programming using Pointers.
7. C Programming using user defined functions (Pass by value and Pass by reference) .
8. C Programming using Recursion.
9. C Programming using structures and union.
10. C Programming using enumerated data types.
11. C Programming using macros and storage classes.
12. C Programming using Files.
13. Develop modularized application for any one of the following scenarios.

Scenarios:

- Student Management System
- Stock Management System
- Banking Application
- Ticket Reservation System

Total (P:45): 45 PERIODS

Hardware/Software Requirements (For a batch of 30 students)

Computer with Windows/Linux OS and C compiler -30 No.s

TEXT BOOKS:

1. Pradip Dey, Manas Ghosh, " Programming in C ", First Edition, Oxford University Press, 2018.
2. Byron S Gottfried, "Programming with C", Schaum's Outlines, Third Edition, Tata McGraw Hill, 2010.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		RBT* LEVEL
CO1	Apply appropriate programming constructs to solve problems.	**3**
CO2	Design, implement, test and debug programs that use the basic features of C.	**5**
CO3	Design modularized applications in C to solve real world problems.	**6**
CO4	Use C pointers and dynamically allocated memory to solve complex problems	**4**
CO5	Apply file operations to develop solutions for real-world problems	**3**
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX:

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.	1	3	-	-	-	-	-	2	3	-	-	2	2	2	1
2.	1	3	-	-	-	-	-	2	3	-	-	2	2	2	1
3.	1	-	3	2	1	-	-	2	3	-	-	2	2	2	1
4.	1	-	3	2	1	-	-	2	3	-	-	2	2	2	1
5.	1	-	3	2	1	-	-	2	3	-	-	2	3	3	1
1- Weak; 2 - Moderate; 3 - Strong.															

SEMESTER II

HS22251	அறிவியல் மற்றும் தொழில்நுட்பத்தில் தமிழ் Science and Technology in Ancient Tamil Society (Common to all branches)	L	T	P	C
		2	0	0	2

பாடத்தின்நோக்கங்கள் :

1. **அறிவியலில் தமிழின் பயன்பாடு பற்றி தெரிந்து கொள்வார்கள்.**
2. **தொழில்நுட்பத்தில் தமிழ் பாரம்பரியத்தின் தாக்கம் பற்றி அறிந்து கொள்வார்கள்.**

Course Objectives :

1. They will know about the use of Tamil in science.
2. Learn about the impact of Tamil heritage on technology.

அலகு 1	**அறிவியல் தமிழ்**	**6**

கருவி உருவாக்கம் – ஆராய்ச்சி மேம்பாடு – கல்வி வளர்ச்சி – அறிவியல் தமிழ் சொற்கள் உருவாக்கம்.

UNIT -1 SCIENTIFIC TAMIL

Tool Development - Research Development - Educational Development - Scientific Tamil words Creation.

அலகு 2	**தொழில்நுட்பத்தில் தமிழ்**	**24**

வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பம் : சங்க காலத்தில் கட்டுமானப் பொருட்கள் – சோழர்களின் பெரியகோவில்கள் மற்றும் பிற வழிபாட்டுதலங்கள் – பல்லவர்களின் சிற்பங்கள் மற்றும் கோவில்கள் (மாமல்லபுரம்) - நாயக்கன் கால கோவில்கள் (மதுரை மீனாட்சி அம்மன் கோவில்), திருமலை நாயக்கர் மஹால், செட்டிநாட்டு வீடுகள்.

உற்பத்தி தொழில் நுட்பம் : கப்பல் கட்டும் கலை, உலோகவியல் ஆய்வுகள், தங்கம், தாமிரம், இரும்பு பற்றிய அறிவு – தொல்பொருள் சான்றுகள் – சுட்டக் களிமண் மணிகள், சங்கு மணிகள், எலும்பு மணிகள்.

விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பம் : அணைகள், ஏரிகள், குளங்கள், மதகுகள், சோழர் கால குமுழி தூம்பு ஆகியவற்றின் முக்கியத்துவம் – கால்நடை பராமரிப்பு, கால்நடைகளின் பயன்பாட்டிற்காக வடிவமைக்கப்பட்ட கிணறுகள். விவசாயம் மற்றும் வேளாண் செயலாக்கம் – கடல் பற்றிய அறிவு – மீன் பிடித்தல், முத்து குளித்தல், சங்கு சேகரித்தல்.

தமிழ் கணினி: அறிவியல் தமிழ் வளர்ச்சி – தமிழ் கணினி, தமிழ் புத்தகங்களின் டிஜிட்டல்மயமாக்கல், தமிழ் டிஜிட்டல் நூலகம், தமிழ் மென்பொருள் உருவாக்கம் – தமிழ் மெய் நிகர் அகாடமி – சொற்குவை திட்டம்.

தமிழின் எதிர்காலமும் தகவல் தொழில்நுட்பமும்- உலகமயமாக்கலும் தகவல் தொழில்நுட்பமும் – கணினிக்கு தமிழ் கற்று கொடுத்தல் – தமிழ்மொழித் தொழில்நுட்பத்தில் வளங்கள்.

UNIT -2 TAMIL IN TECHNOLOGY

Design and Construction Technology : Building materials in Sangam age – Great temples of Cholas and other workship places – Sculptures and Temples of Pallavas (Mamallapuram) – Temples of Nayakas period (Madurai Meenakshi amman temple), Thirumalai Nayakar Mahal, Chetti Nadu Houses.

Manufacturing Technology : Art of Ship building, Metallurgical studies, Knowledge about Gold, Copper, Iron – Archeological evidences – Terracotta beads, Shell beads, Bone beads.

Agriculture and Irrigation Technology: Dams, Tank, ponds, sluice, Significance of Kumuzhi Thoompu of Cholas period- Animal Husbandry, Wells designed for cattle use. Agriculture and Agro processing, - Knowledge about Sea – Fisheries, Pearl, Conche diving.

Tamil Computing : Development of Scientific Tamil – Tamil Computing, Digitization of Tamil books, Tamil Digital Library, Development of Tamil Softwares – Tamil virtual Academy – Sorkuvai project. Future of Tamil and Information Technology- Globalization and Information Technology-Teaching Tamil for Computer-Resources in Tamil Language Technology.

பாடநூல்கள்:

1. டாக்டர், வா.செ .குழந்தைசாமி (1985), "அறிவியல் தமிழ்" , பாரதி பதிப்பகம், 126/108, உஸ்மான் சாலை, தியாகராய நகர் , சென்னை 600017
2. சுப. திண்ணப்பன், (1995), "கணினியும் தமிழ் கற்பித்தலும்", புலமை வெளியீடு, 38-B மண்ணத்நதோட்டத் தெரு, ஆழ்வார்பேட், சென்னை 600018
3. மு. பொன்னவைக்கோ, (2003), "வளர்தமிழில் அறிவியல் – இணையத் தமிழ்", அனைத்திந்திய அறிவியல் தமிழ்க் கழகம், தஞ்சாவூர் 615 005.
4. துரை. மணிகண்டன், (2008), "இணையமும் தமிழும்", நல்நிலம் பதிப்பகம், 7-3, சிமேட்லி சாலை, தியாகராய நகர், சென்னை 600 017.

பாடநெறி முடிவுகள் : படிப்பை வெற்றிகரமாக முடித்தவுடன், மாணவர்கள் பின்வருவனவற்றைச் செய்ய முடியும்.

COURSE OUTCOMES : On completion of the course, the student will be able to

பா.வெ. எண் **CO No**	பாடத்திட்டத்தின்வெளிப்பாடு **Course Outcomes**	**RBT* level**
1	அறிவியலில் தமிழ் மொழியின் பயன்பாடு பற்றி தெரிந்து கொள்வார்கள் They will know about the use of Tamil language in science	2
2	பல்வேறு தொழில்நுட்பத்தில் தமிழ்மொழியின் தாக்கம் பற்றி அறிந்து கொள்வார்கள் They will learn about the influence of Tamil language in various technologies	3
1- Weak; 2 - Moderate; 3 - Strong.		

HS22252	TECHNICAL ENGLISH (Common to all branches)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. Enable learners to define and understand technical communication and scientific writing
2. Expose learners to the technicalities of seminar presentation, group discussion, and public speaking
3. Develop learners' writing skills for scientific and documenting purposes
4. Improve learners' ability to draft correspondences for business purposes
5. Cultivate learners' ability to holistically understand the nuances of job interviews and recruiting process.

UNIT I		**9**

Listening - AV files pertaining to manufacturing processes of products, scientific documentaries; Speaking - syllable division and word stress, intonation, sharing opinions; Reading - news articles related to science and technology; Writing - definitions, instruction, recommendation, data interpretation, resume; Grammar -tenses and their aspects, sentence connectors – discourse markers, sequential words, active and passive voice, subject-verb agreement.

UNIT II		**9**

Listening - AV pertaining to marketing strategies, peer reading and pronunciation; Speaking- turn taking, sharing opinions; conducting and attending a meeting, understanding the nuances of spoken communication among internal audience and external audience; Reading - analytical documents, descriptive documents; Writing - fliers, brochures, resume - letter of application, checklists; Grammar - modal verbs, clauses - types and uses, conditional clauses, articles.

UNIT III		**9**

Listening - AV related to how to use components, scientific description, Speaking - speaking for motivation and initiation, speaking at a seminar presentation; Reading - scientific journals, papers; Writing - Technical descriptions - process description, purpose and function, PowerPoint, Google forms, user manuals; Grammar - phrasal verbs, prepositions, technical and scientific affixes.

UNIT IV		**10**

Listening - scientific debates, crisis management; Speaking - handling conflicts, speaking about the loss of benefits, progress or decline of business, identifying the connotative meanings, Reading- documented evidences of uses and functions of a product, review of a product, Writing - memos, follow-up letters, reports - proposal, project, progress reports, sales reports, reports on industrial visits, executive summary. Grammar - reported speech and tag questions, sentence structure - comparative, imperative, cause and effect, infinitive of result.

UNIT V		**8**

Listening - AV of Group discussions, panel discussions, face to face interviews for recruitment purposes; Speaking- speaking at group discussions, interviewing a personality, answering at the interviews; Reading - WebPages of top notch engineering companies, Writing - blogging, e-mails, letter of complaint, minutes of the meeting; Grammar - one word substitution, collocations, better word/sentence substitution (rephrasing the content/improvising ideas).

	TOTAL: 45 PERIODS

REFERENCES:

1. Department of English, Anna University. *Mindscapes: English for Technologists and Engineers*. Orient Blackswan, Chennai. 2012.
2. Downes, Colm, *Cambridge English for Job-hunting*, Cambridge University Press, New Delhi. 2008.
3. Murphy, Raymond, *Intermediate English Grammar with Answers*, Cambridge University Press 2000.
4. Thomson, A.J., *Practical English Grammar 1 & 2*, Oxford, 1986.
5. Herbert A J, *The Structure of Technical English*, Longman, 1965.

Websites

1. http://www.usingenglish.com
2. http://www.uefap.com3
3. https://owl.english.purdue.edu/owl/
4. www.learnenglishfeelgood.com/esl-printables-worksheets.html

Software

1. Face 2 Face Advance – Cambridge University Press, 2014.
2. English Advance Vocabulary- Cambridge University Press.
3. IELTS test preparation – Cambridge University Press 2017.
4. Official Guide to the TOEFL Test With CD-ROM, 4th Edition.
5. Cambridge Preparation for the TOEFL TEST- Cambridge University Press, 2017.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1.	Understand the nuances of technical communication and scientific writing	**3**
CO2.	Present papers and give seminars	**6**
CO3.	Discuss in groups and brainstorm	**6**
CO4.	Draft business correspondences and write for documenting purposes	**6**
CO5.	Face job interviews with confidence	**6**

***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	-	-	-	-	-	-	-	-	-	3	-	-	-	-
2.	-	-	-	-	-	-	-	-	-	3	-	-	-	-
3.	-	-	-	-	-	-	-	-	-	3	-	-	-	-
4.	-	-	-	-	-	-	-	-	-	3	-	-	-	-
5.	-	-	-	-	-	-	-	-	-	3	-	-	-	-

1- Weak; 2 - Moderate; 3 - Strong.

MA22251	APPLIED MATHEMATICS II (Common to all Branches except MR)	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

The Student should be made to:

1. Acquire the concepts of vector calculus needed for problems in all engineering disciplines and compute different types of integrals using Green's, Stokes' and Divergence theorems.
2. Skilled at the techniques of solving ordinary differential equations that model engineering problems.
3. Extend their ability of using Laplace transforms to create a new domain in which it is easier to handle the problem that is being investigated.
4. Explain geometry of a complex plane and state properties of analytic functions.
5. Understand the standard techniques of complex variable theory so as to apply them with confidence in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.

UNIT I	**VECTOR CALCULUS**	**(9+3)**

Gradient, divergence and curl - Directional derivative - Vector identities – Irrotational and solenoidal vector fields - Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's theorem in a plane, Gauss divergence theorem and Stokes'theorem (excluding proofs) – Verification and application in evaluating line, surface and volume integrals.

UNIT II	**ORDINARY DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS**	**(9+3)**

Differential equations of first order – Equations of the first order and first degree – Linear equations – 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 – Applications of Linear differential equations – Oscillatory electrical circuit – Deflection of beams.

UNIT III	**LAPLACE TRANSFORM**	**(9+3)**

Conditions for existence - Transform of elementary functions - Transforms of unit step function and impulse functions – Basic properties – Shifting theorems - Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Initial and final value theorems - Transform of periodic functions. Inverse Laplace transforms - Convolution theorem – Application to solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT IV	**ANALYTIC FUNCTIONS**	**(9+3)**

Analytic functions - Necessary and sufficient conditions (Cauchy-Riemann equations) - Properties of analytic function - Harmonic conjugates - Construction of analytic functions - Conformal mapping – Mapping by functions $W = Z + C$, CZ, $1/Z$, Z^2 – Joukowski's transformation- Bilinear transformation.

UNIT V	**COMPLEX INTEGRATION**	**(9+3)**

Cauchy's integral theorem - Cauchy's integral formula - Taylor's and Laurent's series expansions - Singular points - Residues - Cauchy's Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semi-circular contour.

TOTAL (L:45+T:15): 60 PERIODS

TEXT BOOKS:

1. Erwin Kreyszing, Herbert Kreyszing, Edward Norminton, "Advanced Engineering Mathematics", 10th Edition, John Wiley, (2015).
2. Grewal .B.S, Grewal .J.S "Higher Engineering Mathematics",43rd Edition, Khanna Publications, Delhi, (2015).

REFERENCES:

1. Dass, H.K., and Rajnish Verma, "Higher Engineering Mathematics", S.Chand Private Ltd., 2011.
2. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2013).
3. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", 9th edition, Laxmi Publications(p) Ltd., 2014.

WEB LINK:

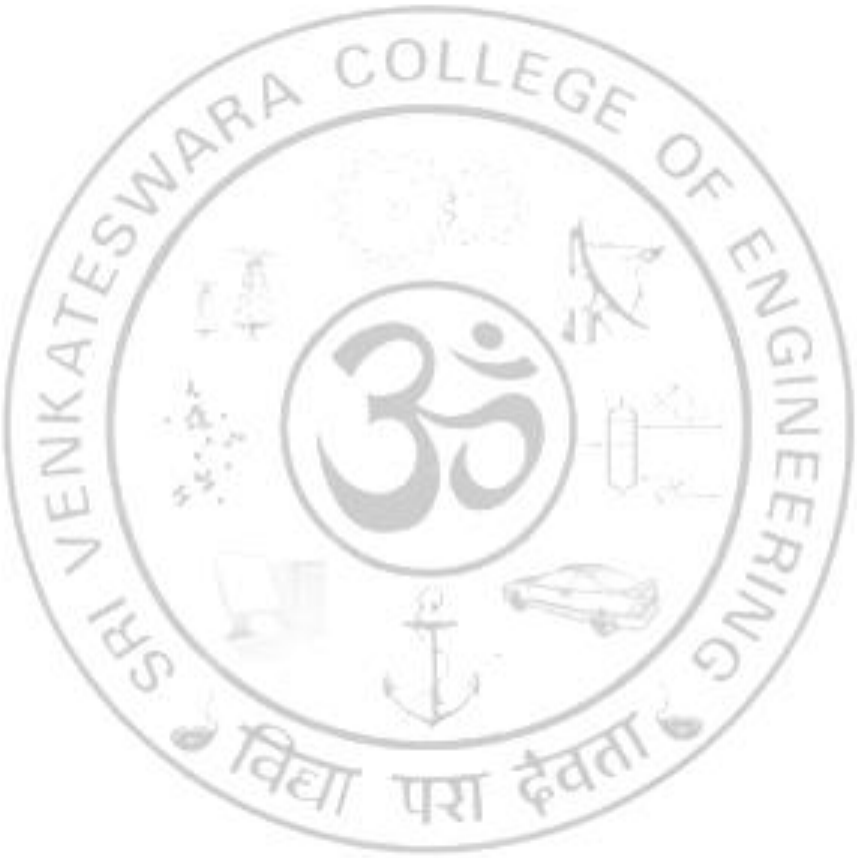
1. https://nptel.ac.in/courses/111/105/111105134/
2. https://nptel.ac.in/courses/111/105/111105121/

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Interpret the fundamentals of vector calculus and execute evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems.	3
CO2	Solve first order linear, homogeneous differential equations and use series solution method to solve second order differential equations.	3
CO3	Determine the methods to solve differential equations using Laplace transforms and Inverse Laplace transforms.	3
CO4	Explain Analytic functions and Categorize transformations.	3
CO5	Perform Complex integration to evaluate real definite integralsusing Cauchy integral theorem and Cauchy's residue theorem.	3

***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	3	2	2	-	-	-	-	-	-	-	3	-	-
2.	3	3	3	3	-	-	-	-	-	-	-	3	-	-
3.	3	3	3	3	-	-	-	-	-	-	-	3	-	-
4.	3	3	-	-	-	-	-	-	-	-	-	3	-	-
5.	3	3	-	-	-	-	-	-	-	-	-	3	-	-
1- Weak; 2 - Moderate; 3 - Strong.														



PH22252	PHYSICS OF MATERIALS (Common to EE and EC)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To understand the physical properties of materials like electrical and thermal conductivity.
2. To understand various types of semiconducting materials, their applications in the field of Engineering and understand the concept of Fermi energy.
3. To understand the different types of dielectric materials and their applications in Engineering fields.
4. To understand the phenomena of superconductor, properties and their applications and the different types of magnetic materials.
5. Ability to understand different types of Transistors and its characteristics and to construct Basic Logic Gates and simplification of circuits using K-map.

UNIT I	**CONDUCTING MATERIALS**	**9**

Introduction – Classification of materials based on the electrical resistivity - Classical Free electron theory – Electrical and thermal conductivity of metal (derivation) – Wiedemann – Franz law – Lorentz number – Drawbacks of Classical Free electron theory – Quantum Free electron theory – Fermi distribution function – Effect of temperature of Fermi function – Density of energy states (derivation) – Carrier concentration in metals – Emission of electrons from metals – Thermionic emission – Photoelectric emission – Field emission

UNIT II	**SEMICONDUCTING MATERIALS**	**9**

Introduction – Classification of materials based on band theory (metals, semiconductors and insulators) – Intrinsic and extrinsic semiconductors – Carrier concentration in intrinsic semiconductor (derivation) - Effect of temperature on Fermi level - Compound semiconductors – Variation of electrical conductivity in intrinsic semiconductors with temperature - Band gap determination of intrinsic semiconductor (derivation and Experiment to determine Band Gap) – Hall effect (derivation and experiment).Tunnel diode, Schottky diode.

UNIT III	**DIELECTRIC PROPERTIES OF MATERIALS**	**9**

Introduction to dielectric materials - Dielectric constant - Polarization of dielectric materials - Types of Polarization (Polarisability) - Equation of internal fields in solid (One- Dimensional) (Derivation) - Clausius – Mossotti Relation for elemental dielectric materials - Dielectric Breakdown - Frequency dependence of dielectric constant, Dielectric Losses - Important applications of dielectric material - Ferro and Piezo electricity (Qualitative).

UNIT IV	**MATERIALS AT LOW TEMPERATURE AND MAGNETIC PROPERTIES**	**10**

Temperature dependence of resistivity in superconducting materials - Meissner effect – Properties of superconductors - Type I and Type II superconductors - BCS theory (Qualitative) – Low Tc and High Tc (alloy) superconductors – Ceramic superconductors (oxide superconductors) - LaBaCuO, YBaCuO, BiSrCaCuO - Josephson's effect (AC and DC) – - Applications of Superconductors-SQUIDS – CRYOTRON – MAG LEV.

Dia, Para and Ferro magnetic material – Domain theory for Ferro magnetic materials - Phenomena of Hysteresis and its applications –Magnetic Semiconductor- Ferrites and its structures.

UNIT V	FUNDAMENTALS OF ELECTRONIC SCIENCE	8
JFET-Drain and Transfer Characteristics- Electronic Transistor(SET), Spintronics-Electronic devices vs Spintronic Devices-Design of Basic Logic gates using transistor, Karnaugh map SoP and PoS forms.		
		TOTAL: 45 PERIODS

TEXT BOOKS:

1. Arumugam M, "Materials Science", Anuradha Publications, 2015.
2. Rajendran V, "Engineering Physics", Tata McGraw Hill, 2015.
3. Suresh R, Jayakumar V, "Materials Science", Lakshmi Publications 2003.
4. Palanisamy P.K, "Materials Science", SciTech publications, 2015.
5. V.K. Mehta , Rohit Mehta, Principles of Electronics", 2020
6. M. Morris Mano, "Digital Design", 3rd edition, Pearson Education, 2014.

REFERENCES:

1. Gaur R.K , Gupta S.L, "Engineering Physics", Dhanpat Publications, 2015.
2. Avadhnaulu M.N , Kshirsagar P.G, "A Textbook of Engineering Physics", S. Chand, 2006.
3. Kittel C, "Introduction to Solid State Physics", 7th Edition, Wiley Eastern Ltd, 2004.
4. Azaroff L.V, Brophy J.J., "Electronic Processes In Materials", McGraw Hill.,1963.
5. A.B. Gupta, Nurul Islam , "Solid State Physics and Electronics", 2017.
6. John F. Wakerley, "Digital Design-Principle & practice", 3rd edition, , Pearson, 2008.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO 1	Comprehend the behavior of electrons in solids.	2
CO 2	Demonstrate an understanding of various properties of Semiconducting materials and their internal structure	3
CO 3	Analyse the properties of dielectric materials and apply them in various fields.	3
CO 4	Summarize basics of magnetism and superconductivity. Explore a few of their technological applications.	2
CO 5	Develop an understanding the Fundamentals of Electronic Science and its applications.	3

***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	-	-	1	-	-	-	-	-	1	-	2	-	-
2.	3	-	-	-	-	-	-	-	-	1	-	2	-	-
3.	3	-	-	-	-	-	-	-	-	1	-	2	-	-
4.	3	2	2	1	2	-	-	-	2	1	-	2	-	-
5.	3	2	2	1	-	2	-	-	2	1	-	2	-	-

1- Weak; 2 - Moderate; 3 - Strong.

EC22201	ELECTRON DEVICES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To provide the necessary skill to understand the basics of semiconductor diode.
2. To provide the basics of bipolar junction transistors.
3. To provide the basics of field effect transistors.
4. To provide comprehensive understanding of special semiconductor diodes.
5. To provide comprehensive understanding of power and display devices.

UNIT I	**SEMICONDUCTOR DIODE**	**9**

PN junction diode, Current equations, Diffusion and drift current densities, forward and reverse bias characteristics, Switching Characteristics, Diode as a Rectifier

UNIT II	**BIPOLAR JUNCTION TRANSISTOR**	**9**

NPN - PNP – Junctions - Early effect - Current equations – Input and Output characteristics of CE, CB, CC – BJT as an amplifier, Hybrid - π model - h-parameter model, Ebers Moll Model-Gummel Poon-model, Multi Emitter transistor.

UNIT III	**FIELD EFFECT TRANSISTORS**	**9**

Review of JFETs – Drain and Transfer characteristics - Current equations - Pinch off voltage and its significance – MOSFET - Characteristics - Threshold voltage - Channel length modulation, D-MOSFET, E-MOSFET- Current equation - Equivalent circuit model and its parameters, FINFET, DUAL GATE MOSFET.

UNIT IV	**SPECIAL SEMICONDUCTOR DEVICES**	**9**

Metal-Semiconductor Junction- MESFET - Zener diode - Varactor diode - Gallium Arsenide device, LASER diode, LDR, PIN Diode, Point Contact Diode, IGBT.

UNIT V	**POWER DEVICES AND DISPLAY DEVICES**	**9**

UJT, SCR, Diac, Triac, Power BJT, LED, Photo diode, Photo transistor, Opto Coupler, Solar cell, LCD, CCD.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Donald A Neaman, “Semiconductor Physics and Devices”, Fourth Edition, Tata Mc Graw Hill Inc., 2012.
2. Adel S. Sedre and Kenneth C. Smith, “Microelectronic Circuits: Theory and Applications”, 6th Edition, Oxford University Press, 2013
3. Robert Boylestad and Louis Nashelsky, “Electron Devices and Circuit Theory”, Pearson Prentice Hall, 11th edition, 2013.
4. Dr. Sanjay Sharma, “Basic Electronics”, First Edition, S.K. Kataria & Sons, 2012.

REFERENCES:

1. Jacob Millman & Christos C. Halkias, “Electronic Devices & Circuits”, Fourth Edition, McGraw Hill 2015.
2. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, “Electronic Devices and circuits”, Third Edition, Tata McGraw Hill, 2012.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Gain knowledge of PN diodes.	2
CO2	Analyze the characteristics of BJT and use it in designing simple circuits.	4
CO3	Analyze the characteristics of FET and use it in designing simple circuits.	4
CO4	Analyze the working principle of Special diodes and use it in designing simple circuits.	4
CO5	Analyze the working principle of power and display devices and use it in designing simple circuits.	4
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	3	-	2	2	-	-	-	-	1	-	-	3	3
2.	3	3	-	3	2	-	-	-	-	1	-	-	3	3
3.	3	3	-	3	2	-	-	-	-	1	-	-	3	3
4.	3	2	-	1	2	-	-	-	-	1	-	-	3	3
5.	3	2	-	1	2	-	-	-	-	1	-	-	3	3
1- Weak; 2 - Moderate; 3 - Strong.														

EC22202	CIRCUIT THEORY	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

1. To analyze electrical network with suitable network theorems.
2. To classify and analyze series and parallel resonance and coupled circuit.
3. To determine the transient response of RL, RC and RLC circuits for AC and DC inputs.
4. To infer the concept two-port networks.
5. To sketch the network topology.

UNIT I	**NETWORK THEOREMS FOR DC & AC CIRCUITS**	**12**

Thevenin Theorem, Norton's Theorem, Superposition Theorem, Reciprocity theorem, Maximum Power transfer Theorem - Analysis using Dependent Current sources and Voltage sources.

UNIT II	**RESONANCE AND COUPLED CIRCUITS**	**9**

Resonance: Series and parallel resonance – Frequency response – Quality factor and Bandwidth-Selectivity-Basic filter design.

Coupled Circuits: Self and Mutual inductance – Dot rule-Coefficient of coupling – Linear Transformer – Ideal Transformer - Tuned circuits – Single tuned circuits.

UNIT III	**TRANSIENT ANALYSIS**	**9**

Basic RL and RC Circuits, The Source- Free RL Circuit, The Source-Free RC Circuit, The Unit Step Function, Transient response of RL, RC and RLC Circuits using Laplace transform for DC and AC input.

UNIT IV	**TWO PORT NETWORKS**	**6**

Characterization of two port networks in terms of Z, Y, ABCD and h parameters. Interconnection of two port network, Symmetrical properties of T and π networks.

UNIT V	**NETWORK TOPOLOGY**	**9**

Network terminology - Graph of a network - Trees and Co-Tree - Twigs and Links - Incidence Matrix (A), Properties of Incidence Matrix (A) - Link Current and Tie-set Matrix (B) - Twig Voltages and Cut-set Matrix (C) - Mesh Analysis and Nodal Analysis.

L: 45 PERIODS

Practical Exercises:

1. Verifications of KVL & KCL.
2. Verifications of Thevenin & Norton's theorem.
3. Verification of Superposition Theorem.
4. Verification of maximum power transfer Theorem
5. Determination of Resonance Frequency of Series & Parallel RLC Circuits.
6. Transient analysis of RL and RC circuits.
7. Determination of Z and Y parameters for the two port network.

P: 30 PERIODS

TOTAL PERIODS: 75

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:	
	Quantity
Resistors, Capacitors, Inductors	Required
Bread Boards	15
CRO (30MHz)	5
Function Generators (3MHz)	5
Multimeter	5
Dual Regulated Power Supplies (0 – 30)V	10
Voltmeter and Ammeter	Required

TEXT BOOKS:

1. Hayt Jack Kemmerly, Steven Durbin, "Engineering Circuit Analysis", Mc Graw Hill education, 9th Edition, 2018.
2. Joseph Edminister and Mahmood Nahvi, ― Electric Circuits, Schaum‘s Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

REFERENCES:

1. David Bell, "Fundamentals of Electric Circuits", Oxford University press, 7th Edition, 2009.
2. John O Mallay, Schaum’s Outlines "Basic Circuit Analysis", The Mc Graw Hill companies, 2nd Edition, 2011
3. Robert.L. Boylestead, "Introductory Circuit Analysis", Pearson Education India, 12th Edition, 2014.
4. Sudhakar, A., Shyammohan, S. P. “Circuits and Networks”; Tata McGraw-Hill New Delhi, 2015.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Apply suitable network theorems and analyze AC and DC circuits.	3
CO2	Infer the phenomenon of series and parallel resonance in electrical circuits and understand the effect of magnetic coupling between windings.	2
CO3	Analyze the transient response for any RC, RL and RLC circuits.	4
CO4	Evaluate the two port network parameters.	5
CO5	Sketch the various network topologies.	4

***Bloom’s Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	3	-	3	3	-	-	-	-	-	-	-	3	3
2.	3	3	-	3	3	-	-	-	-	-	-	-	3	3
3.	3	3	-	2	3	-	-	-	-	-	-	-	3	3
4.	3	3	-	2	2	-	-	-	-	-	-	-	3	3
5.	3	3	-	1	-	-	-	-	-	-	-	-	3	3

1- Weak; 2 - Moderate; 3 - Strong.

CY22161	CHEMISTRY LABORATORY (Common to all Branches except AD, CS & IT)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

The objective of the ChemistryLaboratory is to acquaint the students with the basic phenomenon/concepts of chemistry, the student face during course of their study in the industry and Engineering field.

1. To appreciate the need and importance of water quality parameters for industrial and domestic use.
2. To gain the knowledge on electrochemical instrumention techniques like potentialand current measuring used in electrochemistry applications
3. To impart knowledge on separation of componentsusing paper chromatography.
4. To enhance the thinking capabilityabout polymer and properties like molecular weight.

LIST OF EXPERIMENTS (Minimum 8 Experiments)

1. Determination of DO content of water sample by Winkler's method.
2. Determination of strength of given hydrochloric acid using pH meter
3. Determination of strength of acids in a mixture using conductivity meter
4. Estimation of iron content of the water sample using spectrophotometer (phenanthroline / thiocyanate method)
5. Determination of total, temporary & permanent hardness of water by EDTA Method.
6. Estimation of iron content of the given solution using potentiometer.
7. Determination of alkalinity in water sample.
8. Determination of Single electrode potential.
9. Separation of components from a mixture of red and blue inks using Paper chromatography.
10. Determination of molecular weight of polymer by using Ostwald's/Ubbelohde viscometer.

TOTAL: 15 Periods

REFERENCES:

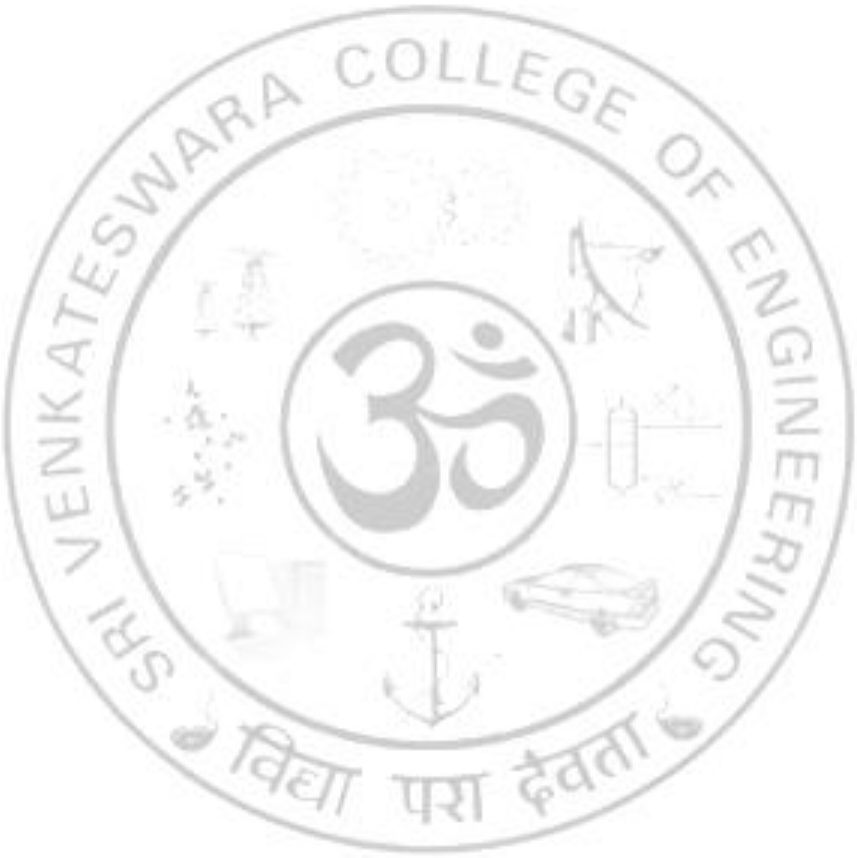
1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel"s Textbook of practical organic chemistry", LBS Singapore 1994.
3. Jeffery G.H., Bassett J., Mendham J.and Denny vogel"s R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980

COURSE OUTCOMES: On the successful completion of the course, students will be able to		**RBT* Level**
CO1	Distinguish hard and soft water, solve the related numerical problems on water, purification and its significance in industry and daily life.	4
CO2	Interpret the knowledge of instruments to measure potential and current related parameters.	2
CO3	Demonstrate the basic principle for separation of components using paper chromatography.	4
CO4	Evaluate the molecular weight of polymer using Ostwald's/Ubbelohde viscometer.	4

***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	-	-	-	3	3	3	1	-	1	2	-	-
CO2	3	2	1	-	-	3	3	3	-	-	-	-	-	-
CO3	3	-	-	-	-	3	3	-	-	-	-	2	-	-
CO4	3	-	-	1	-	3	3	3	-	-	-	-	-	-
1- Weak; 2 - Moderate; 3 - Strong.														



EC22211	TECHNICAL DRAWING LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

1. To draw free hand sketches of the schematic diagrams of electronic circuits using standard symbols.
2. To prepare the drawing from the rough sketches and/or enlarge/reduce the given drawing to the desired scale.
3. To draw the cables and connectors using CAD tools.
4. To draw exploded views of components & assemblies in preparation of service drawing.
5. To construct and verify the electric circuits using simulation tools.

LIST OF EXPERIMENTS

1. **Drawing Fundamentals on Electronics**
   (a) Hand drawing Symbols of all the electronic components.
   (b) Soldering of resistive components.
2. **Drawing of standard symbols of basic electronic components using AutoCAD Electrical**
   (a) Resistors, Capacitors, Inductors, Potentiometer, Crystal, Switches and Transformers
   (b) Active Devices – AC and DC sources, PN diode, Zener Diode, Varactor Diode, LED, BJT, JFET, MOSFET, UJT, SCR, DIAC, TRIAC
   (c) Telephone components – Transmitter, Receiver, Filter, Hybrid Transformer
   (d) Logic Gates – NOT, AND, OR, XOR, NAND, NOR
3. **Drawing cables and connectors using AutoCAD Electrical**
4. **Drawing Electric circuits:**
   (a) Circuit diagram of a Wein's bridge oscillator
   (b) Circuit diagram of a Battery eliminator
   (c) Circuit of Emergency light
   (d) Circuit diagram of Voltage stabilizers
   (e) Circuit diagram of Fan regulator
5. **Drawing of electronic components - 2D and 3D view**
6. **Construction and Verification of Electric circuits using simulation tools.**

TOTAL: 30 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

Description of Items	Quantity
PC Desktop	10
Soldering Iron with accessories	10
AutoCAD software	10

TEXT BOOKS:

1. Prof. Sham Tickoo, "AutoCAD Electrical 2020 for Electrical Control Designers", 11th Edition, Tickoo-CADCIM Series, ISBN: 978-1-64057-079-5.
2. Gaurav Verma, Matt Weber, "AutoCAD Electrical 2016 Black Book.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Perform free-hand sketching of electronic circuits.	3
CO2	Draw the complete circuit with the correct dimensions.	4
CO3	Demonstrate computer-aided drawing for fabricating electronic products.	4
CO4	Project the 2D and 3D views of electronic components.	3
CO5	Construct the electric circuit using SPICE simulator.	4
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	1	-	-	-	-	-	-	3	-	-	-	2	1
2.	3	1	-	-	3	-	-	-	3	-	-	-	2	3
3.	3	1	-	-	3	-	-	-	3	-	-	-	2	3
4.	3	1	-	-	3	-	-	-	3	-	-	-	2	3
5.	3	1	-	-	3	-	-	-	3	-	-	-	2	3
1- Weak; 2 - Moderate; 3 - Strong														

EC22212	ELECTRON DEVICES AND ELECTRICAL MACHINES LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

1. To be exposed to the characteristics of basic electronic devices.
2. To be exposed to study the behavior of various passive and active electronic components
3. To be familiar with the working of diodes, transistors and their applications.
4. To impart hands on experience on rudimentary engineering practices in Electrical Engineering
5. To understand the Concepts of Solar PV system
6. To familiarize with the operation of DC machines, AC machines and Transformers equip with experimental skills.

LIST OF EXPERIMENTS:

ELECTRON DEVICES

1. VI Characteristics of PN Diode and PN Diode as a Rectifier
2. Reverse Characteristics of Zener Diode and Zener Diode as a Regulator
3. Input-Output Characteristics of BJT in CE configuration
4. Drain and Transfer Characteristics of JFET
5. VI Characteristics of LED and Photo Diode/Photo Transistor
6. VI Characteristics of UJT and SCR

ELECTRICAL MACHINES

1. Residential house wiring using switches, fuse, indicator, lamps and energy meter
2. Load test on single-phase transformer
3. Load test on DC shunt motor
4. Speed Control of DC shunt motor
5. Load test on three phase Induction motor
6. Load test on single phase Induction motor
7. Study of 1kWp Solar PV System with Net meter

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS: (ELECTRON DEVICES)

	Quantity
BC107, BC148, 2N2646, BFW10	Required
1N4007, Zener diodes	Required
Bread Boards	15
CRO (30MHz)	5
Function Generators (3MHz)	5
Multimeter	5
Dual Regulated Power Supplies (0 – 30)V	10
Voltmeter and Ammeter	Required

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS: (ELECTRICAL MACHINES)

	Quantity
1. Assorted electrical components for house wiring	2 sets
2. 1Kw Solar PV system	1
3. DC Shunt Motor - 1.5kW, 220V, 9A, 1500RPM,	1
4. DC Shunt Motor with Loading Arrangement- 3.5kW, 220 Volts, 18.6 Amps, 1500 RPM	1
5. Single Phase Transformer- 1 KVA, 230/115V, 50Hz	2

6. Three Phase Induction Motor with Loading Arrangement- 3.7kW, 415V, 7.8A, 1430 RPM	1
7. Single Phase Induction Motor with Loading Arrangement-1.5kW, 230V,9.9A,1440rpm	1
8. Single Phase Auto Transformer- 4KVA, 0-270V, 50Hz	2
9. Three Phase Auto Transformer - 12KVA, 0-415V, 50Hz	2
10. MC Voltmeter- (0-300)V	3
11. MC Ammeter- (0-10/20)A	2
12. MC Ammeter - (0-1/2)A	2
13. MI Voltmeter - (0-300/600)V	5
14. MI Voltmeter - (0-75/150)V	2
15. MI Ammeter - (0-10)A	5
16. UPF Wattmeter (300/600V, 5/10A)	4
17. Single Phase Resistive Loading Bank- 5 KW)	2
18. Rheostats - 50Ω,5A, 700Ω,1.5A,1000Ω,1A)	Each 2
19. Single phase Energy meter	1
20. Net meter	1
21. Fuse various ranges as per the requirement	Required
22. Wires As per the requirement	Required

TEXT BOOKS: (Electronics Part)

1. Jacob Millman & Christos C. Halkias, “Electronic Devices & Circuits”, Fourth Edition, McGraw Hill, 2015.
2. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, “Electronic Devices and circuits”, Third Edition, Tata McGraw Hill, 2012.

TEXT BOOKS: (Electricals Part)

1. Arora, B.D, “HOUSE WIRING” R.B.Publishers (1999).
2. Uppal, S.L; Laroia, J.M “ELECTRICAL WIRING ESTIMATING AND COSTING “ Khanna Publishers (2003).
3. Theraja, B.L; Theraja A.K , “A TEXTBOOK OF ELECTRICAL TECHNOLOGY VOLUME II: AC AND DC MACHINES “ S.Chand publications,(2015).
4. Rai G.D, “Non-conventional Energy Sources”, Khanna Publishers (2014).

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Learn the characteristics of basic electronic devices.	2
CO2	Construct, analyze and troubleshoot the designed circuits.	4
CO3	Implement the various wiring methods.	4
CO4	Analyze the behavior of DC machines, AC machines and Transformers.	4
CO5	Evaluate the performance of Solar PV system.	4

***Bloom’s Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6

COURSE ARTICULATION MATRIX:

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	2	-	-	3	-	-	-	3	-	-	-	2	3
2.	3	2	-	-	3	-	-	-	3	-	-	-	2	3
3.	3	3	-	-	3	-	-	-	3	-	-	-	2	3
4.	3	3	-	-	3	-	-	-	3	-	-	-	2	3
5.	3	3	-	-	3	-	-	-	3	-	-	-	2	3
1- Weak; 2 - Moderate; 3 - Strong														

SEMESTER III

MA22358	TRANSFORMS AND RANDOM PROCESSES	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

1. To introduce Fourier series analysis this is central to many applications in engineering.
2. To understand the basic concepts of the Fourier transform and Z-transform techniques and its application in Engineering.
3. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes.
4. To provide the required Mathematical support in real life problems and develop probabilistic models. This can be used in several areas of science and engineering. To acquire skills in handling situations involving more than one random variable and functions of random variables.
5. To Understand and characterize phenomena which evolve with respect to time in Probabilistic manner.

UNIT I	**FOURIER SERIES**	**9+3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series –Parseval's identity – Harmonic Analysis

UNIT II	**FOURIER AND Z -TRANSFORMS**	**9+3**

Fourier transform pair – Fourier sine and cosine transforms – Properties (without proof) – Convolution theorem – Parseval's identity. Z- Transforms – Elementary properties – Inverse Z - transform (using partial fraction) – Convolution theorem – Solution of difference equations using Z - transform.

UNIT III	**PARTIAL DIFFERENTIAL EQUATION**	**9+3**

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear homogeneous partial differential equations of second and higher order with constant coefficients.

UNIT IV	**RANDOM VARIABLE**	**9+3**

Discrete and continuous random variables – Moment generating functions. Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression –Central limit theorem.

UNIT V	**RANDOM PROCESS**	**9+3**

Classification – Stationary process – Poisson process – Gaussian process - Random telegraph process - Auto correlation functions.

TOTAL: (L:45 + T:15): 60 PERIODS

TEXT BOOKS:

1. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi 2012.
2. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt. Ltd. 1998.
3. Ibe. O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007.
4. Peebles Jr. P.Z., "Probability Random Variables and Random Signal Principles", Tata McGraw-Hill Publishers, Fourth Edition, New Delhi, 2002.

REFERENCES:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", *10* th Edition, Wiley India, 2011.
2. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd , 2007
3. Veerarajan. T., "Transforms and Partial Differential Equations", Tata MGraw Hill Publishing Company Ltd., New Delhi, 2012
4. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.

Links:

1. https://nptel.ac.in/courses/111103021
2. http://bme.elektro.dtu.dk/31610/notes/RandomProcess_California.pdf
3. http://www.ifp.illinois.edu/~hajek/Papers/randomprocJuly14.pdf

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Acquire the skill in examining a signal in another domain rather in the original domain by handling Full and Half Range Fourier Series.	3
CO2	Develops the skill of conversion between time domain to frequency domain using the concept of Fourier Transforms and Z-transform.	3
CO3	Express proficiency in handling higher order Partial differential equations	3
CO4	Reproduce and explain the basic concepts such as probability and random variable and identify the distribution. Acquire skills in handling situations involving more than one random variable	3
CO5	Apply the relationship within and between random processes	3

***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6

COURSE ARTICULATION MATRIX

*Cos	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	3	3	3	-	-	-	-	-	-	-	2	-	-
2.	3	3	3	3	-	-	-	-	-	-	-	-	2	2
3.	3	3	3	3	-	-	-	-	-	-	-	2	-	-
4.	3	3	-	-	-	-	-	-	-	-	-	2	2	2
5.	3	3	-	-	-	-	-	-	-	-	-	-	2	2
1- Weak; 2 - Moderate; 3 - Strong.														

EC22301	OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To acquire knowledge on core programming basics of C++ language.
2. To possess a fundamental understanding of an Object-Oriented Programming concepts.
3. To deepen the empirical knowledge on linear and non-linear data structures.
4. To develop logical thinking abilities to relate real world problems with data structure concepts in an object-oriented style.
5. To be familiar with different sorting and searching algorithms.

UNIT I	**DATA ABSTRACTION & OVERLOADING**	**9**

Overview of C++ – Structures – Class Scope and Accessing Class Members – Reference Variables – Initialization – Constructors – Destructors – Member Functions and Classes – Friend Function – Dynamic Memory Allocation – Static Class Members – Proxy Classes – Overloading: Function overloading and Operator Overloading.

UNIT II	**INHERITANCE & POLYMORPHISM**	**9**

Base Classes and Derived Classes – Protected Members – Casting Class pointers and Member Functions – Overriding – Public, Protected and Private - Inheritance – Types of Inheritance- Constructors and Destructors in derived Classes – Implicit Derived – Composition Vs. Inheritance – Virtual functions – This Pointer – Abstract Base Classes and Concrete Classes – Virtual Destructors – Dynamic Binding

UNIT III	**LINEAR DATA STRUCTURES**	**9**

Abstract Data Types (ADTs) – List ADT – Array based linked list implementation — Singly linked lists – Doubly linked list - Polynomial Manipulation - Stack ADT – Evaluating arithmetic expressions- Queue ADT – Circular Queue implementation.

UNIT IV	**NON-LINEAR DATA STRUCTURES**	**9**

Trees – Binary Trees – Binary tree representation and traversals - The Search Tree ADT - Binary Search Trees- – Application of trees – Graph and its representations – Graph Traversals – Representation of Graphs – Breadth-first search – Depth-first search- Dijkstra's shortest path algorithm.

UNIT V	**SORTING AND SEARCHING**	**9**

Insertion sort - Shell sort – Selection Sort - Bubble sort - Merge sort - Quick sort - Radix Sort - Searching: Linear search − Binary Search.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Deitel and Deitel, "C++, How To Program", Tenth Edition, Pearson Education, 2017.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 2nd Edition, Pearson Education, 2017.

REFERENCES:

1. Bjarne Stroustrup, "The C++ programming language", Fourth Edition, Addison Wesley, 2018.
2. Bhushan Trivedi, “Programming with ANSI C++, A Step-By-Step approach”, Oxford University Press, 2012.
3. Goodrich, Michael T., Roberto Tamassia, David Mount, “Data Structures and Algorithms in C++”, Second Edition, Wiley. 2011.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, MIT Press, 2009.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT Level**
CO1	Read, Write and Execute simple C++ programs.	2
CO2	Choose appropriate object-oriented programming principles and propose novel solution to solve computational problem.	3
CO3	Understand the core data structures like lists, stack and queue using C++.	2
CO4	Design and implement non-linear data structures using C++ programs.	3
CO5	Discuss different sorting and searching techniques to organizing the large amount of data.	3
***Bloom’s Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

***COs**	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	3	-	-	-	-	-	-	2	3	-	3	-	3
2.	3	3	2	-	-	-	-	-	3	-	-	3	3	3
3.	3	2	2	-	-	-	-	-	2	3	-	3	3	-
4.	3	2	-	-	-	-	-	-	-	-	-	3	-	3
5.	3	3	-	-	-	-	-	-	-	3	-	3	2	3
1- Weak; 2 - Moderate; 3 - Strong.														

EC22302	DIGITAL SYSTEM DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To understand Boolean algebra and illustrate boolean expression simplification using Karnaugh ma
2. Design combinational circuits using logic gates.
3. Describe latches,flip flops,registers and counters.
4. Investigate and design synchronous and asynchronous sequential circuits.
5. Examine the applications of digital circuits.

UNIT I	**DIGITAL FUNDAMENTALS**	**7**

A review of Boolean algebra and minimization using Boolean postulates-minterms and maxterms, SOP, POS- Minimization of Boolean expression using Karnaugh's map: 3 variables, 4 variables and 5 variables-Don't care combinations-Implementation of Logic Functions using gates, NAND–NOR implementation

UNIT II	**COMBINATIONAL CIRCUIT DESIGN**	**9**

Arithmetic operations: Half adder, full adder, ripple carry adder, lookahead adder, BCD adder-subtractor-binary multiplier-Barrel shifter-Selection logic: multiplexer, demultiplexer, decoder, encoder, priority encoder.

UNIT III	**SEQUENTIAL CIRCUIT DESIGN**	**9**

Latches and Flip flops: SR, JK, T, D and Master slave flipflop, excitation tables and excitation equations,realization of one flip flop using other flip flops-Counters: Synchronous and asynchronous counters- Shift registers-Types, Universal shift registers.

UNIT IV	**FINITE STATE MACHINE: SYNCHRONOUS AND ASYNCHRONOUS**	**10**

FSM-Mealy machine, Moore machine-state machine analysis, state diagram, state assignment, state minimization-Asynchronous logic design- Hazards-types and design of hazard free circuit, cycles and race conditions- race free assignment.

UNIT V	**APPLICATIONS OF DIGITAL CIRCUITS**	**10**

Design of sequence detector, code converters and comparator-design of Serial adder-design of digital circuits using PLA,PAL, ROMs
Case study-ALU, MAC and pipelined adder.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Morris Mano M and Michael D. Ciletti, Digital Design, Pearson, Fifth Edition, 2015
2. S. Lee, "Digital Circuits and Logic Design," 1st Ed., Prentice Hall India, 2008.
3. D. P. Leach, A.P. Malvino and G. Saha, "Digital Principles and Applications," 8th Ed., McGraw Hill Education, 2014.

REFERENCES:

1. Charles H. Roth and Larry M. Hanny, Fundamentals of Logic Design, Cengage learning, Sixth Edition, 2013
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, Digital Integrated circuits: A design perspective, Pearson, Second Edition, 2016.
3. Kenneth L. Short, VHDL for Engineers, Prentice Hall, 2009.
4. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006
5. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT Level**
CO1	Examine different methods used for simplification of Boolean expressions.	2
CO2	Design combinational logic circuits using logic gates.	3
CO3	Design sequential logic circuits using flipflops.	3
CO4	Investigate and design synchronous and asynchronous sequential circuits.	4
CO5	Apply the digital circuits for solving real world problems and implement the logic function using different types of PLD.	4
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

***COs**	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	3	-	-	-	-	-	-	-	-	-	2	2	-
2.	3	2	3	3	2	-	-	2	-	-	-	2	3	2
3.	3	2	3	3	2	-	-	2	-	-	-	2	3	2
4.	3	2	3	3	2	-	2	-	-	-	-	2	3	2
5.	3	3	3	3	2	1	2	2	-	-	-	3	3	2
1- Weak; 2 - Moderate; 3 - Strong.														

EC22303	ELECTROMAGNETIC FIELDS AND WAVES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce students with different coordinate systems and to understand the Theorem, Laws, Principle and their related problems over Static Electric Fields.
2. To learn the basic laws in Static Magnetic Field and able to find various parameters with the related problems.
3. To know how the Electric Field is applied in Dielectrics with various equations and applications and to understand how the Magnetic Field works with Ferromagnetic Materials.
4. To analyze how the Time is Varying in both Electric and Magnetic Fields with various derivation.
5. To understand and analyze the Electromagnetic Field distribution which forms the basis for advanced subjects related to Electromagnetic Field.

UNIT I	**STATIC ELECTRIC FIELD**	**9**

Review of Co-ordinate System-Introduction to line, Surface and Volume Integrals-Meaning of Stokes theorem and Divergence theorem.

Coulomb's Law and Electric field Intensity-Principle of Superposition-Electric field due to discrete charges-Electric field due to continuous charge distribution-Electric field due to charges distributed uniformly on an infinite and finite line-Electric Field on the axis of a uniformly charged circular disc-Electric Field due to an infinite uniformly charged sheet. Electric Flux Density-Gauss Law and its applications.

UNIT II	**STATIC MAGNETIC FIELD**	**9**

The Biot-Savart Law-Magnetic Field intensity due to a finite and infinite wire carrying a current I-Magnetic field intensity on the axis of a circular and rectangular loop carrying a current I–Ampere's circuital law-Force on a wire carrying a current I placed in a magnetic field–Torque on a loop carrying a current I

UNIT III	**ELECTRIC AND MAGNETIC FIELDS IN MATERIALS**	**9**

Poisson's and Laplace's equation-Capacitance of various geometries using Laplace's equation-Boundary conditions for electric fields-Point form of ohm's law-Continuity equation for current.

Inductance of loops and solenoids-Energy density in magnetic fields-magnetization and permeability-Magnetic boundary conditions.

UNIT IV	**TIME VARYING ELECTRIC AND MAGNETIC FIELDS**	**9**

Maxwell's Equation from Ampere's Law, Faraday's Law and Gauss Law in both point form and Intergral form and Time Varying Potentials.

UNIT V	**ELECTROMAGNETIC WAVES**	**9**

Poynting Vector-Instantaneous Average and Complex Poynting Vector-Wave Equation-Uniform plane waves-Maxwell's equation in Phasor form-Plane waves in free space and in a homogeneous material-Skin effect.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David K Cheng, "Field and Wave Electromagnetics", Pearson Education Inc, Delhi, 2004.
2. John D Kraus and Daniel A Fleisch, "Electromagnetics with Applications", McGraw Hill Book Co,2005.
3. W H.Hayt & J A Buck: "Engineering Electromagnetics" TATA McGraw-Hill, 7th Edition 2007.
4. M.N.O.Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th ed., Oxford(Asian Edition), 2015

REFERENCES:

1. E.C. Jordan & K.G.Balmain "Electromagnetic Waves and Radiating Systems." Prentice Hall of India 2nd edition 2003.
2. Narayana Rao. N: "Engineering Electromagnetics" 4th edition, Prentice Hall of India, New Delhi, 2006.
3. Electromagnetics Joseph Edminister - Schaum's Outline Series, TMH

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Apply the fundamentals of different coordinate systems to relate the electromagnetic concepts in Engineering.	3
CO2	Evaluate the physical quantities of electromagnetic fields in different media .	4
CO3	Analyze the boundary conditions for different media and to design the storage devices.	3
CO4	Justify concepts of electromagnetic waves means of transporting energy in dielectric medium.	4
CO5	Analyze the concept of Plane waves in homogeneous medium.	3
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

***COs**	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	3	3	-	-	2	-	-	-	2	-	2	3	-
2.	3	3	3	-	-	2	-	-	-	2	-	2	3	-
3.	3	3	3	-	-	2	-	-	-	2	-	2	3	-
4.	3	3	3	-	-	2	-	-	-	2	-	2	3	-
5.	3	3	3	-	-	2	-	-	-	2	-	2	3	-
1- Weak; 2 - Moderate; 3 - Strong.														

EC22304	ELECTRONIC CIRCUITS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To learn about biasing of BJT and FET circuits.
2. To understand the design and working principle of BJT and FET.
3. To understand the small signal analysis of BJT and FET.
4. To study about feedback amplifiers.
5. To understand the analysis and design of power amplifier and tuned amplifier.

UNIT I	**TRANSISTOR BIASING**	**9**

BJT Biasing Circuits – Types, Q Point, Bias Stability, Stability factors- Concept of DC and AC load lines, Fixing of operating point. Biasing methods for JFET and MOSFET.

UNIT II	**BJT AMPLIFIERS**	**7**

Transistor amplifying action – small signal analysis of CE amplifier – AC load line – Voltage swing limitations. Darlington amplifier, Cascaded stages – Cascode amplifier – Frequency response of CE amplifier. Bandwidth of Single Stage and Multistage Amplifiers.

UNIT III	**JFET and MOSFET Amplifiers**	**9**

Small signal analysis of MOSFET and JFET- Common Source amplifiers- Voltage swing limitations- Source follower and Common gate amplifiers and BIMOS amplifiers.

UNIT IV	**FEEDBACK AMPLIFIERS AND OSCILLATORS**	**10**

Advantages of negative feedback – Voltage / Current Series, Shunt feedback amplifiers- Positive feedback – Conditions for oscillations, Phase shift , Wien bridge, Hartley, Colpitt's and Crystal oscillators.

UNIT V	**POWER AMPLIFIERS AND TUNED AMPLIFIERS**	**10**

Power amplifiers- Types. Analysis and Types of Class A, Class B, Class AB. Small signal tuned amplifiers – Analysis of capacitor coupled single tuned amplifier – double tuned amplifier – Stagger tuned amplifiers Stability of tuned amplifiers – Neutralization – Hazeltine neutralization method.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David A. Bell, Solid state Pulse Circuits, PHI, 4th Edition 2007.
2. Robert L Boylestead and Louis Nashelsky, "Electronic Devices and circuit theory", Pearson, Tenth edition 2009.
3. Sedra and Smith, "Micro Electronic Circuits"; Sixth Edition, Oxford University Press, 2011.

REFERENCES:

1. Millman and Halkias. C., Integrated Electronics, TMH, 2007.
2. S.Salivahanan, N. Suresh Kumar and A. Vallava Raj, "Electronic Devices and circuits", TMH, 2nd Edition 2008.
3. Spencer R. R. and M. S. Ghausi, Introduction to Electronic Circuit Design, Pearson, 2003,
4. Schilling and Belove, Electronic Circuits, 3rd Edition, TMH, 2002.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Choose appropriate biasing circuits for BJT and MOSFET discrete amplifiers.	4
CO2	Design and analyze BJT amplifier.	4
CO3	Analyze the modeling of MOSFET amplifiers.	4
CO4	Design feedback amplifiers and analyze stabilization techniques and Oscillators	4
CO5	Analyze Power amplifiers and tuned amplifiers	4
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

***COs**	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	3	-	3	3	-	-	-	-	-	-	2	3	3
2.	3	3	3	3	3	-	-	-	-	-	-	2	3	3
3.	3	3	3	3	3	-	-	-	-	-	-	2	3	3
4.	3	2	-	3	3	-	-	-	-	-	-	2	3	3
5.	3	2	-	3	-	-	2	-	-	-	-	2	3	2
1- Weak; 2 - Moderate; 3 - Strong.														

EC22305	SIGNALS AND SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To understand the fundamentals of signals & systems
2. To analyze continuous time signals in Fourier and Laplace domain
3. To analyze discrete time signals in Fourier and Z domain
4. To study the characteristics of continuous time systems
5. To study the characteristics of discrete time systems

UNIT I	FUNDAMENTALS OF SIGNALS AND SYSTEMS	9

Signals: Continuous time and Discrete time - Elementary signals - Basic operations on signals- Signal properties – Periodicity, Deterministic and Stochastic, Energy & Power
Systems: Continuous time and Discrete time - System properties – Linearity: additivity and homogeneity, Time-invariance, Causality, Stability, Invertibility.

UNIT II	ANALYSIS OF CONTINUOUS TIME SIGNALS	9

Continuous Time Fourier Transform (CTFT) - Periodic and Aperiodic signals - Convergence of CTFT - Properties: Linearity, Symmetry, Time shifting, Time scaling, Parseval's theorem, Convolution.
Laplace Transform - Unilateral and Bilateral Laplace Transform - Region of Convergence - Properties: Linearity, Symmetry, Time shifting, Time scaling, Initial and Final value theorem, Convolution, Inverse Laplace Transform.

UNIT III	LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS	9

Differential Equation - Impulse response - Convolution integrals and its properties – Analysis of systems using Fourier and Laplace transforms: Stability and Causality - Frequency response, Impulse response and Transfer function of LTI systems.

UNIT IV	ANALYSIS OF DISCRETE TIME SIGNALS	9

Sampling and reconstruction of signals: Sampling Theorem, Effects of under sampling: aliasing - Discrete Time Fourier transform (DTFT) - Properties: Linearity, Periodicity, Symmetry, Time shifting, Frequency shifting, Time scaling, convolution,
Z -Transform – Region of Convergence - Properties: Linearity, Symmetry, Time reversal, Time scaling, Time shifting, Differentiation, Convolution – Inverse Z - transform – Relationship between DTFT and Z transform

UNIT V	LINEAR SHIFT INVARIANT DISCRETE TIME SYSTEMS	9

Difference equation – Convolution sum and its properties - Interconnection of LSI Systems – Analysis of LSI systems using DTFT and Z transform: Stability and Causality - Frequency response, Impulse response and Transfer function of LSI systems

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Alan V Oppenheim, Alan S Wilsky, and S Hamid Nawab, "Signals and Systems", Pearson, 2013.
2. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.

REFERENCES:

1. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2008
2. M.J.Roberts, "Signals & Systems Analysis using Transform Methods & MATLAB", Tata McGraw Hill, 2012.
3. R.E.Zeimer, W.H.Tranter and R.D.Fannin, "Signals & Systems – Continuous and Discrete", Pearson, 2014.
4. Simon Haykin, Barry Van Veen, "Signals and Systems" , Wiley, 2003

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Categorize signals and systems based on their properties.	3
CO2	Analyze the characteristics of continuous time signals using Fourier and Laplace transform.	4
CO3	Characterize the Linear Time Invariant systems in time and frequency domain.	3
CO4	Analyze the characteristics of discrete time signals using Fourier transform and Z transform.	4
CO5	Characterize the Linear Shift Invariant systems in time and frequency domain.	3
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

***COs**	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	3	2	3	3	1	1	-	2	-	-	1	3	3
2.	3	3	3	3	3	1	-	-	2	-	-	1	3	3
3.	3	3	3	3	3	1	-	-	2	-	-	1	3	3
4.	3	3	3	3	3	1	-	-	2	-	-	1	3	3
5.	3	3	3	3	3	1	-	-	2	-	-	1	3	3
1- Weak; 2 - Moderate; 3 - Strong.														

EC22311	ANALOG AND DIGITAL CIRCUITS LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

Analog:

1. To study the frequency response characteristics of BJT and FET amplifiers
2. To learn the characteristics of IGBT and its application
3. To design low and high frequency oscillators
4. To simulate various analog circuits using SPICE

Digital:

5. To study the fundamentals of combinational and sequential circuits
6. To design, implement and verify the functionality of various digital circuits

LIST OF EXPERIMENTS

ANALOG CIRCUITS

1. Frequency response of CE and CS amplifier
2. Frequency response of series/shunt feedback amplifier
3. Design of single tuned amplifier
4. Design of low and high frequency oscillator
5. Design an application using IGBT
6. Simulation of frequency response of CE and CS amplifier using SPICE

DIGITAL CIRCUITS

1. Implementation of binary adder and subtractor
2. Implementation of decimal adder
3. Implementation of logic design using multiplexer/decoder
4. Data transfer using shift register
5. Design of counters
6. Design of sequence detector

CHALLENGING EXPERIMENTS (Any one)

1. Blinking LED using active and passive components
2. Design of Buzzer using Counter
3. Automatic Night Light using LDR
4. Simple Water level indicator using active and passive components

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

Description of Items	Quantity
CRO (Min 30MHz)	15
Signal Generator /Function Generators (2 MHz)	15
Dual Regulated Power Supply (0 – 30V)	15
Digital Multimeter	5
LCR Meter	5
Standalone desktops PC	10
SPICE Circuit Simulation Software	15
IC Trainer Kit	15
Bread Boards	25
ICs 7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 /74151 / 74147 / 7445 /	25 Each

7476/7491/ 555 / 7494 / 7447 / 74180 / 7485 / 7473 / 74138 / 7411 / 7474	

TEXT BOOKS:

1. Robert L Boylestad, Louis Nashelsky, Lab Manual to accompany "Electronic Devices and Circuit Theory", 11th Edition, Pearson Education, 2012
2. M. Morris Mano, Michael D. Ciletti, "Digital Design", Global Edition, Pearson Higher Education & Professional Group, 2018

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Design and analyze the frequency response characteristics and bandwidth of various amplifiers using BJT & FET and using simulation tool	4
CO2	Analyze the characteristics of tuned amplifiers and IGBT	4
CO3	Design low and high frequency oscillators	4
CO4	Design, implement and verify the functionality of combinational digital circuits	4
CO5	Design, implement and verify the functionality of sequential digital circuits	4
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	3	3	3	3	1	1	1	-	-	-	2	3	3
2.	3	3	3	3	3	1	1	1	-	-	-	2	3	3
3.	3	3	3	3	3	1	1	1	-	-	-	2	3	3
4.	3	3	3	3	3	-	-	1	-	-	-	2	3	3
5.	3	3	3	3	3	-	-	1	-	-	-	2	3	3
1- Weak; 2 - Moderate; 3 - Strong.														

EC22312	OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

The students should be made:

1. To be familiar with good programming design methods, particularly in Bottom- up design.
2. To understand Object-oriented methodology.
3. To develop C++ programs for data structures and its applications.
4. To relate real world problems with data structures concepts in an object-oriented style.
5. To understand different sorting and searching techniques.

LIST OF EXPERIMENTS

1. Write C++ Programs for
    i. Prime number generation
    ii. Factorial with and without recursion
    iii. Bank account using Constructor and destructor.
    iv. Static data member and member function.
    v. Friend Function.
    vi. Area and of a circle, square, rectangle and triangle using function overloading
    vii. Operator Overloading
    viii. Inheritance – Single, Multiple, Multilevel, Hybrid and Hierarchical
    ix. Virtual Function
2. Array implementation of List ADT.
3. Linked list implementation.
4. Doubly Linked list implementation.
5. Application of List - Polynomial Manipulation
6. Stack ADT - Array and linked list implementations.
7. Application of Stack:
    i. Evaluation of Arithmetic Expressions
    ii. Converting Decimal to Binary
8. Queue ADT – Array and linked list implementations.
9. Binary Search Tree with Tree traversal Techniques – Preorder, Post-order and In-order.
10. Graphs - Breadth-first search and Depth-first search.
11. Sorting – Insertion, Merge and Quick sort.
12. Searching – Linear and Binary Search.

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

Description of Items	Quantity
Standalone desktops with C++ compiler	30

TEXT BOOKS:

1. Deitel and Deitel, “C++, How To Program”, Tenth Edition, Pearson Education, 2017.
2. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, 2nd Edition, Pearson Education, 2017.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT Level**
CO1	Create C++ programs to implement Classes & Objects, friend function, constructors & destructors.	2
CO2	Design and implement various forms of inheritance and polymorphism	3
CO3	Deploy various data structure concepts like linked lists, stacks, queues, trees and graphs using C++ program.	3
CO4	Analyze real world problems and possess novel solutions to it in an object-oriented style	3
CO5	Use different sorting and searching algorithms.	2
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	3	3	-	-	-	-	-	2	3	-	3	-	3
2.	3	3	3	-	-	-	-	-	3	-	-	3	3	3
3.	3	3	3	-	-	-	-	-	2	3	-	3	3	-
4.	3	2	-	-	-	-	-	-	-	-	-	2	-	3
5.	2	2	-	-	-	-	-	-	-	3	-	-	2	3
1- Weak; 2 - Moderate; 3 - Strong.														

SEMESTER IV

EC22401	ANALOG INTEGRATED CIRCUITS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the basic building blocks of linear integrated circuits
2. To construct the linear and non-linear applications of operational amplifiers
3. To introduce the various data converters and its working principles.
4. To introduce the theory and applications of analog multipliers and PLL.
5. To study various special function ICs

UNIT I	**BASICS OF OPERATIONAL AMPLIFIERS**	**9**

General operational amplifier stages -BJT Differential amplifier analysis-Concept of CMRR – methods to improve CMRR- Wilson Current source-IC 741-Ideal Operational Amplifier - DC and AC performance characteristics, Open and Closed loop configurations of Op-amp-Inverting, Non-inverting and Differential amplifiers-Voltage Follower.

UNIT II	**APPLICATIONS OF OPERATIONAL AMPLIFIERS**	**9**

Linear Circuits: Adder and Subtractor, Differentiator, Integrator, Voltage to Current converter, Instrumentation amplifier, **Nonlinear Circuits:** Sine wave Oscillators, Active filters-LPF, HPF, BPF, Comparator, Multivibrators, Schmitt trigger, Precision rectifier, Log and Antilog amplifiers.

UNIT III	**ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS**	**9**

Sample and hold circuit, Types of D/A converter-Weighted Resistor,R-2R Current driven DAC, A/D converter - Flash, Single slope, Dual slope, Successive approximation.

UNIT IV	**ANALOG MULTIPLIER AND PLL**	**9**

Gilbert Multiplier cell - Variable transconductance technique, analog multiplier ICs and their applications, Voltage Controlled Oscillator, Operation of the basic PLL, Closed loop analysis of PLL, Monolithic PLL IC 565, Applications of PLL-Frequency synthesizing, AM detection, FM detection and FSK demodulation.

		9
UNIT V	**SPECIAL FUNCTION ICS**	

555 Timer, Voltage regulators - linear and switched mode types, Switched capacitor filter, SMPS, features of TPS40200, TPS40210 buck and boost converters, Frequency to Voltage converters, ICL 8038 function generator, Isolation Amplifiers, Audio Amplifier, Video amplifiers, Fiber optics ICs and Opto couplers.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. D.Roy Choudhry, Shail Jain, “Linear Integrated Circuits”, New Age International Pvt. Ltd., 2018, Fifth Edition.
2. Sergio Franco “Design with Operational Amplifiers and Analog Integrated Circuits”, 4th Edition, Tata McGraw-Hill, 2016.

REFERENCES:

1. B.S.Sonde, "System design using Integrated Circuits", 2nd Edition, New Age Pub, 2001.
2. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2001.
3. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, 5th Edition, 2009.
4. Michael Jacob, "Applications and Design with Analog Integrated Circuits", Prentice Hall of India, 1996.
5. .Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2015.
6. William D.Stanley, "Operational Amplifiers with Linear Integrated Circuits", Pearson Education, 4th Edition, 2001.
7. S. Salivahanan, V S Kanchana Baskaran, "Linear Integrated Circuits", second edition, McGraw-Hill education India pvt ltd., 2015.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Infer the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques.	2
CO2	Elucidate and analyze the linear and non-linear applications of an opamp.	4
CO3	Classify and comprehend the working principle of data converters.	4
CO4	Illustrate the function of application specific ICs such as Analog multiplier, PLL and its application in communication.	2
CO5	Explain the working of multivibrators using IC 555, the special function ICs such as Voltage regulators, buck-boost converters, A/V amplifiers etc.	3
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

***COs**	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1.	3	3	1	-	2	2	-	-	-	-	-	3	3	2
2.	3	2	1	-	2	3	-	-	-	-	-	3	3	2
3.	3	2	1	-	2	2	-	-	-	-	-	3	3	2
4.	3	2	1	-	2	2	-	-	-	-	-	3	3	2
5.	3	3	3	-	2	3	-	-	-	-	-	3	3	2
1- Weak; 2 - Moderate; 3 - Strong.														

EC22402	LINEAR CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the elements of control system and its representations
2. To analyze the time response and stability of systems
3. To learn various frequency response plots
4. To study the state variable representation of systems
5. To design various types of compensators

UNIT I	**SYSTEM COMPONENTS AND THEIR REPRESENTATION**	**9**

Control System: Terminology and Basic Structure -Feed forward and Feedback control theory - Modeling of Electrical and Mechanical Systems: Block diagram models-Signal flow graphs models- - Introduction to multivariable control system

UNIT II	**TIME RESPONSE AND STABILITY ANALYSIS**	**11**

Time response: Transient and Steady state response - Impulse and Step response analysis of first and second order systems - Steady state errors - Concepts of stability-Routh stability criterion- Relative Stability - Root Locus Technique- Guidelines for sketching root locus - P, PI, PD and PID Controllers: characteristics and applications

UNIT III	**FREQUENCY RESPONSE AND STABILITY ANALYSIS**	**9**

Frequency response: Closed loop – Frequency response of second order system - Frequency domain specifications - Bode plot- Polar plot - Stability analysis -Nyquist stability criterion

UNIT IV	**CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS**	**8**

State variable representation: state equations - Conversion of state variable models to transfer functions and vice versa - Solution of state equations - Concepts of Controllability and Observability

UNIT V	**COMPENSATORS**	**8**

Compensators - Effect of adding poles and zeros – Design of cascade lag, lead and lag-lead compensators using Bode plot

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Nagarath I.J. and Gopal M., "Control Systems Engineering", New Age International Publishers, 2017
2. Norman S Nise, "Control Systems Engineering", 7th Edition, Wiley, 2015
3. Benjamin C. Kuo, "Automatic Control systems", Wiley, 2014

REFERENCES:

1. M. Gopal, "Control Systems, Principles and Design", 4th Edition, Tata McGraw Hill, New Delhi, 2012.
2. S.K.Bhattacharya, "Control System Engineering", 3rd Edition, Pearson, 2013.
3. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Prentice Hall, 2012.
4. K. Ogata, "Modern Control Engineering", 5th edition, PHI, 2012.
5. NPTEL Online Courses on "Control Engineering" and "Digital Control Systems".

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT Level**
CO1	Compute the transfer function of different physical systems	3
CO2	Compute the time response and analyze the stability using various techniques.	3
CO3	Illustrate the frequency response characteristics of open loop and closed loop systems.	4
CO4	Illustrate the state space model of a physical system	4
CO5	Design compensators to satisfy the desired specifications of control systems	3
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

***COs**	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1.	3	2	2	2	-	-	-	-	-	-	-	3	3	3
2.	3	2	2	2	3	-	-	-	-	-	-	3	3	3
3.	3	2	2	2	3	-	-	-	-	-	-	3	3	3
4.	3	2	2	2	-	-	-	-	-	-	-	3	3	3
5.	3	2	2	2	3	-	-	-	-	-	-	3	3	3
1- Weak; 2 - Moderate; 3 - Strong.														

EC22408	MACHINE LEARNING: THEORY AND PRACTICES	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

1. To learn the basic concepts of machine learning.
2. To learn and build supervised learning models.
3. To learn and build unsupervised learning models.
4. To evaluate the algorithms based on corresponding metrics identified
5. To analyse the machine learning experiments

UNIT I	**INTRODUCTION TO MACHINE LEARNING**	**8**

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

UNIT II	**SUPERVISED LEARNING**	**10**

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests

UNIT III	**ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING**	**9**

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.

UNIT IV	**NEURAL NETWORKS**	**9**

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

UNIT V	**DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS**	**9**

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test

L: 45 PERIODS

Practical Exercises:

1. Write a python program to import and export data using Pandas library functions and data Visualization Techniques. (3 hours)
2. Demonstrate various data pre-processing techniques for a given dataset. (2 hours)
3. Implement Simple and Multiple Linear Regression Models(2 hours)
4. Develop Decision Tree Classification model for a given dataset and use it to classify a new sample. (2 hours)
5. Implement Naïve Bayes Classification in Python. (2 hours)
6. Implement Random forest ensemble method on a given dataset. (2 hours)
7. Build KNN Classification model for a given dataset. (2 hours)
8. Implement classification using SVM. (2 hours)
9. Implement classification using Multilayer perceptron(2 hours)
10. Implement of ADAM optimiser from scratch (2 hours)
11. Evaluating ML algorithm with balanced and unbalanced datasets Comparison of Machine Learning algorithms. (3 hours)
12. Performance analysis of specific datasets (mini project) (6 hours)

	P: 30 PERIODS	
	TOTAL PERIODS: 75	

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

	Quantity
1. Processors: Intel Atom® processor or Intel® Core™ i3 processor. Disk space: 1 GB. Operating systems: Windows 7/10	15 Nos.
2. Python versions: 3.6.X. with Anaconda 2020.07	15 Nos.

TEXT BOOKS:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014

REFERENCES:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2012, 2018.
4. 4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016
5. Sebastain Raschka, Vahid Mirjalili , "Python Machine Learning", Packt publishing, 3rd Edition, 2019.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Explain the basic concepts of machine learning.	2
CO2	Construct supervised learning models.	3
CO3	Construct unsupervised learning algorithms.	3
CO4	Evaluate and compare different models	4
CO5	Evaluate the machine learning experiments	4
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

***COs**	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	3	3	3	3	2	-	-	-	-	1	1	3	3
2.	3	3	3	3	3	2	-	-	-	-	1	1	3	3
3.	3	3	3	3	3	2	-	-	-	-	1	1	3	3
4.	3	3	2	2	2	2	-	-	-	-	1	1	3	1
5.	3	2	2	2	3	2	-	-	-	-	1	1	3	3
1- Weak; 2 - Moderate; 3 - Strong.														

EC22409	MICROCONTROLLER SYSTEMS: THEORY AND PRACTICES	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

1. To understand the fundamentals of PIC 16f84A and Atmega microcontrollers.
2. To develop Programme using Embedded 'C' and introduced to the 'C' Data types.
3. To introduce the concepts of timer/counters, Serial ports and interrupts using PIC and SPI, I^2C, LCD and Keyboard using Atmega.
4. To develop Programme codes for interfacing keyboard/display,motor and sensor using PIC and Atmega.
5. To Interface sensors, motors, relays, and various input/output devices and programming with PIC16f84A and Atmega microcontrollers.

UNIT I	**INTRODUCTION TO PIC MICROCONTROLLER**	**9**

Architecture-16F84/16F877, Register File Structure, Addressing Modes, Assembly Language Programming-Arithmetic and Logical Instructions, Branch, Call and Time Delay Loop, PIC I/O Port Programming.

		9
UNIT II	**PIC PROGRAMMING IN C**	

Data types and time delays in C-I/O Programming-Logical Operations-Data Serialization-Program ROM allocation -Data RAM allocation.

UNIT III	**PIC PERIPHERALS AND INTERFACING**	**9**

Timer Programming, Serial Port Programming, Interrupt Programming, LCD and Keyboard Interfacing, ADC, DAC and Sensor Interfacing, Motor Control.

UNIT IV	**INTRODUCTION TO ATMEL AVR MICROCONTROLLER**	**9**

AVR Architecture, Registers and Data Memory, Instruction Set-Branch, Call and Time Delay Loop, Datatypes and directives, Parallel I/O Port, Programming in 'C'

UNIT V	**AVR PERIPHERAL INTERFACING**	**9**

Timer/counters, Analog Interface, SPI, I^2C, LCD and Keyboard, PWM Programming and DC Motor control.

L: 45 PERIODS

Practical Exercises:

1. Verification of Logic Gates (OR, AND & NOT), LED interfacing using PIC16f84A.
2. Interfacing PWM to control the brightness of LED using PIC16f84A.
3. LCD Interfacing using PIC16f84A.
4. Stepper Motor Interfacing using PIC16f84A.
5. Temperature sensor Interfacing using PIC16f84A.
6. Verification of Logic Gates (XOR, NAND & NOR), LED interfacing using ATMEGA.
7. Interfacing DC motor to control the RPM of Motor using ATMEGA.
8. LCD and Keyboard Interfacing using ATMEGA.
9. Servo Motor Interfacing using ATMEGA.
10. Ultrasonic sensor Interfacing using ATMEGA.
11. Application Development using PIC/ATMEGA.

	P: 30 PERIODS
	TOTAL PERIODS: 75

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:	
	Quantity
PIC Universal Programmer and IC	15 nos
ATMEGA Programmer and IC	15 nos
LCD	10 nos
Ultrasonic Sensor	10 nos
DC motors and DC motor Drivers	10 nos
Stepper motors and drivers	10 nos
Temperature sensor and Interface	10 nos
LED	30 nos
1KΩ and 10 KΩ	40 nos
Crystal Oscillator16 MHz	40 nos
Capacitor 22pf	40 nos
Matrix Keypad	10 nos

TEXT BOOKS:

1. Muhammad Ali Mazidi, Rolin D.Mckinlay, Danny Causey, "PIC Microcontroller and Embedded Systems Using ASM & C for PIC18", Pearson Education International, Edition 2008.
2. Muhammad Ali Mazidi,Sepehr Naimi, Sarmad Naimi, "The AVR Microcontroller and Embedded systems Using Assembly and C", Pearson Education International, Edition 2017
3. Richard H.Barnett,Sarah Cox,Larry O'Cull, "Embedded C programming and the Atmel AVR", Cengage Learning India Private Limited, January 2007.

REFERENCES:

5. Peatman,J.B., "Design with PIC Micro Controllers "Pearson Education, 3rd Edition, 2004.
6. Tim Wilmshurst, "Designing Embedded Systems with PIC Microcontrollers – Principles and Applications", Newnes Publication, 2007
7. John Iovine, 'PIC Microcontroller Project Book ', McGraw Hill 2000
8. Julio Sanchez Maria P. Canton, "Microcontroller Programming: The microchip PIC", CRC Press, Taylor & Francis Group, 2007

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Identify and understand function of different blocks of PIC and Atmega microcontroller.	3
CO2	Develop programs for data transfer, arithmetic, logical and I/O port operations for PIC16 using "C"	4
CO3	Develop programs for Serial port, Timers, Interrupts and various Interfacing devices with PIC16f84A and Atmega Microcontrollers.	4
CO4	Develop program codes with PIC16f84A and Atmega for specific application.	4
CO5	Measure the performance of A/D and D/A.	3
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

***COs**	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	2	3	3	3	-	-	-	1	-	-	-	3	3
2.	3	3	3	3	3	-	-	-	3	-	-	-	3	3
3.	3	3	3	3	3	-	-	-	3	-	-	-	3	3
4.	3	3	3	3	3	-	-	-	3	-	-	-	3	3
5.	3	2	3	3	3	-	-	-	1	-	-	-	3	3
1- Weak; 2 - Moderate; 3 - Strong.														

EC22403	DISCRETE TIME SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To learn Discrete Fourier Transform, properties of DFT and FFT.
2. To know the characteristics and design of FIR filter.
3. To design a IIR filters to filter undesired signals.
4. To understand Finite word length effects.
5. To study the concept of Digital Signal Processors and various applications of Digital Signal Processing.

UNIT I	**DISCRETE FOURIER TRANSFORM**	**9**

DSP advantages – Introduction to DFT – Properties of DFT – Circular Convolution - Filtering methods based on DFT – FFT Algorithms – Decimation-in-Time (DIT), Decimation-in-Frequency (DIF).

UNIT II	**DESIGN OF FIR FILTER**	**9**

Linear phase FIR filter - Symmetric, Antisymmetric filters - Filter design (Low Pass, High Pass filters) using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Need for choice of window- Realization structures of FIR Filter - Transversal, Poly-phase and Linear phase structures.

UNIT III	**DESIGN OF IIR FILTER**	**9**

Characteristics of Analog filters – Butterworth filters, Chebyshev Type I filters. Transformation of analog filters into equivalent digital filters using Impulse invariant method and Bilinear transformation method - Realization structures for IIR filters – direct, cascade, parallel forms.

UNIT IV	**FINITE WORD LENGTH EFFECTS**	**9**

Fixed point and floating point number representations – ADC – Quantization- Truncation and Rounding errors - Quantization noise – coefficient quantization error – Product quantization error – Round-off noise power - limit cycle oscillations due to product round off and overflow errors – Principle of scaling.

UNIT V	**APPLICATIONS OF DIGITAL SIGNAL PROCESSING**	**9**

Digital Signal Processors-Fixed and floating point; Basic Architectural features, Introduction to Multirate Signal Processing- Decimation, Interpolation, Sampling rate conversion by a rational factor, Applications of DSP to Image and Speech signal processing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. B. Venkataramani and M. Bhaskar, ―Digital Signal Processors – Architecture, Programming and Applications‖ – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
3. Rafael C.Gonzalez & Richard E.Woods – Digital Image Processing – Pearson Education- 4/e – Reprint 2018
4. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education India, 2008.

REFERENCES:

1. Alan V. Oppenheim and Ronald W. Schafer, "Discrete-Time Signal Processing" 3rd edition, 2010, Prentice Hall, Upper Saddle River, NJ.
2. Sanjit Mitra, "Digital Signal Processing", 4th edition, 2011, McGraw-Hill, New York, NY.
3. DSP Processor and Fundamentals: Architecture and Features. Phil Lapsley, JBier, Amit Sohan, Edward A Lee; Wiley IEEE Press;2009
4. Weltch , T.B., Wright, C.H.G. and Morrow, G.M., "Real-Time Digital Signal Processing from MATLAB to C with the TMS320C6x DSPs.", 2nd Ed., CRC Press,2011.
5. Rabiner, L.R. and Schafer, R.W., "Digital Processing of Speech Signals", Pearson Education, 2003.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Analyze the frequency spectrum of Discrete time signal using Discrete Fourier Transform and Fast Fourier Transform.	4
CO2	Interpret the characteristics of FIR filters and articulate the design of Finite Impulse Response filters for filtering undesired signals.	3
CO3	Observe the IIR filter characteristics and design IIR filters according to the user specifications.	3
CO4	Assess the word length effects in signal processing systems.	4
CO5	Explore the architecture of Digital Signal Processor and inspect the various applications of Digital Signal Processing.	3
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

***COs**	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1.	3	3	3	3	3	2	-	-	-	-	1	1	3	3
2.	3	3	3	3	3	2	-	-	-	-	1	1	3	3
3.	3	3	3	3	3	2	-	-	-	-	1	1	3	3
4.	3	3	2	2	2	2	-	-	-	-	1	1	3	1
5.	3	2	2	2	3	2	-	-	-	-	1	1	3	3
1- Weak; 2 - Moderate; 3 - Strong.														

GE22451	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY (Common to all Branches)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize the biodiversity of India and its conservation.
2. To impart knowledge on the causes, effects and control or prevention measures of environmental pollution.
3. To study and understand the various types of renewable sources of energy and their applications.
4. To familiarize the concept of sustainable development goals, economic and social aspects of sustainability, recognize and analyze climate changes, and environmental management challenges.
5. To inculcate and embrace sustainability practices, develop a broader understanding of green materials and energy cycles, and analyze the role of sustainable urbanization.

UNIT I	ENVIRONMENT AND BIODIVERSITY	9

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– food chains, food webs and ecological pyramids, ecological succession. Biodiversity- types- genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: fragmentation and habitat loss, poaching of wildlife, human-wildlife conflicts – endangered and endemic species of India –conservation of biodiversity: In-situ and ex-situ.

UNIT II	ENVIRONMENTAL POLLUTION	9

Definition, causes, effects and preventive measures of air, water and soil pollution. Marine and thermal pollution - causes, effects and control measures. Light and noise pollution - effect on flora and fauna. Nuclear pollution- Sources, effects and control measures. Disposal of radioactive wastes (Nuclear hazards). Pollution case studies. Role of an individual in the prevention of pollution. Solid, hazardous and E-waste management. Occupational health and safety management system (OHASMS). Environmental protection, Environmental protection acts, categorization of spices according to IUCN.

UNIT III	RENEWABLE SOURCES OF ENERGY	9

Energy resources: Growing energy needs, Nonrenewable resources – types, uses. Energy management and conservation - New energy sources, Need of new sources - geo suitability of establishing renewable energy sources, different types new energy sources. Applications of hydrogen energy, ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Role of an individual in conservation of energy.

UNIT IV	SUSTAINABILITY AND MANAGEMENT	9

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols, Sustainable Development Goals-targets, indicators and intervention areas - Principles of green chemistry, Climate change- Global, Regional and local environmental issues and possible solutions-case studies - Role of non-governmental organization, Concept of carbon credit, carbon

footprint - Environmental management in industry - A case study,		
UNIT V	**SUSTAINABILITY PRACTICES**	**9**
Zero waste and R concept, circular economy, ISO 18000 series, material life cycle assessment, environmental impact assessment. Wasteland reclamation, Sustainable habitat: green buildings, green materials, energy efficiency and energy audit, sustainable transports. Energy cycles, carbon cycle, emission and sequestration, Green engineering: sustainable urbanization- socio-economical and technological change. Rainwater harvesting, watershed management, environmental ethics: Issues and possible solutions.		
	TOTAL: 45 PERIODS	

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 7th Edition, New Age International Publishers, 2022.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Pearson. 2011.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, CL Engineering, 2015.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 3rd edition, 2015.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 3rd edition, 2021.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Explain the fundamental role of ecosystems and biodiversity and discuss the importance of their conservation.	2
CO2	Describe the different types of pollution, their effects and strategies to minimize or eliminate pollution.	2
CO3	Identify the need of renewable and non-renewable resources and describe energy management measures to preserve them for future generations.	2
CO4	Explain the various goals of sustainable development applicable for suitable technological advancement and societal development.	2
CO5	Demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.	2
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

***COs**	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	-	-	-	-	3	3	2	-	2	-	1	-	-
2.	3	-	-	-	-	3	3	2	-	2	-	2	-	-
3.	3	-	1	-	-	3	3	1	-	2	-	1	-	-
4.	3	-	-	-	-	3	3	3	-	2	-	2	-	-
5.	3	-	-	-	-	3	3	3	-	2	-	2	-	-
1- Weak; 2 - Moderate; 3 - Strong.														

EC22411	ANALOG INTEGRATED CIRCUITS AND SIMULATION LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

1. To expose the students to linear and integrated circuits
2. To understand the basics of linear integrated circuits and available ICs
3. To understand characteristics of operational amplifier.
4. To apply operational amplifiers in linear and nonlinear applications.
5. To acquire the basic knowledge of special function IC.
6. To use any simulation software for circuit design

LIST OF EXPERIMENTS

1. Design of inverting and non-inverting amplifier using Op-amp.
2. Design of integrator and differentiator using Op-amp.
3. Design of instrumentation amplifier using Op-amp.
4. Design of active low-pass, high-pass and Narrow band-pass filters using Op-amp.
5. Design of Astable and Monostable multivibrators using Op-amp.
6. Design of Schmitt Trigger using Op-amp.
7. Design of Wein Bridge and Colpitt's Oscillator Using Op-amp.
8. Applications of NE555 Timer.
9. PLL characteristics and its use as Frequency Multiplier.
10. DC power supply design using LM317 and LM723.
11. Simulation of experiments 3,4,5,6 using any simulation software.

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

Description of Items	Quantity
CRO (Min 30MHz)	15 Nos.
Signal Generator /Function Generators (2 MHz)	15 Nos.
Dual Regulated Power Supplies (0 — 30V)	15 Nos.
Digital Multimeter	15 Nos.
IC tester	5 Nos.
Standalone desktops PC	15 Nos.
Circuit Simulation Software: (any public domain or commercial software)	15 Nos.
Components and Accessories: Op-Amps, Resistors, Capacitors, diodes, Zener diodes, Bread Boards, Transformers, wires, Power transistors, Potentiometer, LEDs.	
Op-Amps uA741, LM 301, LM311, LM 324, LM317, LM723, 7805, 7812, 2N3524, 2N3525, 2N3391, AD 633, LM 555, LM 565	

TEXT BOOKS:

1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2018, Fifth Edition.
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, Tata McGraw-Hill, 2016.
3. Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2015.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Develop a various linear and nonlinear applications using Operational Amplifier.	4
CO2	Construct Astable and Monostable Multivibrator using NE555 Timer.	4
CO3	Examine the Characteristics and applications of PLL.	3
CO4	Design DC Power supply using LM317 and LM723.	4
CO5	Simulate and validate the results of various operational amplifier applications using any simulation software.	3
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1.	3	3	3	2	-	-	-	-	-	-	-	3	3	2
2.	3	3	3	2	-	-	-	-	-	-	-	3	3	2
3.	3	3	3	3	-	-	-	-	-	-	-	3	3	2
4.	3	3	3	2	-	2	2	-	-	-	-	3	3	2
5.	3	3	3	2	3	-	-	-	-	-	-	3	3	3
1- Weak; 2 - Moderate; 3 - Strong.														

EC22412	DISCRETE TIME SIGNAL PROCESSING LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

1. To implement DFT and FFT.
2. To implement Linear and Circular Convolution.
3. To design a FIR filter using windowing method.
4. To design a IIR filter.
5. To study the architecture of DSP processor.

LIST OF EXPERIMENTS

Experiments using MATLAB

1. Generation of elementary Discrete-Time sequences
2. Study of properties of LTI systems using Simulink
3. Linear and Circular convolution, Cross correlation of two sequences
4. Discrete Fourier Transform (DFT) and Inverse Discrete Fourier Transform (IDFT)
5. Radix-2 FFT algorithms - Decimation in Time / Decimation in Frequency
6. Spectral estimation through DTFT and DFT
7. Design of digital Butterworth and Chebyshev IIR filter
8. Design of FIR filter (LPF/HPF/BPF/BSF) and demonstrates the filtering operation
9. Processing of an image : Representation, Histogram plot, Image filtering

Experiments using DSP processor

1. Study of architecture of Digital Signal Processor
2. MAC application in LTI systems.
3. Generation of various signals
4. Design of FIR filter
5. Implementation of Up-sampling and Down-sampling

Mini Project (Any one)

1. Noise cancellation of audio signal
2. Disease detection based on EEG/ECG
3. Simple Image processing Technique

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

Description of Items	Quantity
PCs with Fixed / Floating point DSP Processors (Kit / Add-on Cards)	15
MATLAB with Simulink and Signal Processing Tool Box or Equivalent Software in desktop systems	15 Licenses

TEXT BOOKS:

1. John G. Proakis& Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. B. Venkataramani and M. Bhaskar, ―Digital Signal Processors – Architecture, Programming and Applications‖ – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.

3. Rafael C.Gonzalez & Richard E.Woods – Digital Image Processing – Pearson Education- 4/e – Reprint 2018
4. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education India, 2008.

COURSE OUTCOMES: Upon successful completion of the course, students should be able to:		**RBT* Level**
CO1	Simulate standard signals.	3
CO2	Demonstrate the applications of FFT in signal processing	3
CO3	Design digital filters.	3
CO4	Demonstrate their abilities towards DSP processor based implementation of DSP systems	3
CO5	Implement signal processing applications in image and speech signal.	3
***Bloom's Taxonomy (RBT) Level:** Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	1	3	2	2	3	-	-	-	-	-	-	-	1	1
2.	3	3	1	2	3	2	-	-	2	-	-	-	3	3
3.	3	3	1	2	3	2	2	-	2	-	-	-	3	3
4.	3	3	1	2	3	2	-	-	-	-	-	-	2	2
5.	2	3	2	2	3	3	2	-	2	-	-	-	3	3
1- Weak; 2 - Moderate; 3 - Strong.														