ESTD. 1939

KARNATAK LAW SOCIETY'S
GOGTE INSTITUTE OF TECHNOLOGY
"JNANA GANGA" UDYAMBAG, BELAGAVI-590008,
KARNATAKA, INDIA.
Approved by AICTE & UGC
Permanently Affiliated and Autonomous Institution Under
Visvesvaraya Technological University, Belagavi
www.git.edu

ESTD. 1979

2018-19 Scheme

Department: Electronics and Communication Engineering

Programme: B.E. (Electronics and Communication Engineering)

3rd to 8th Semester Scheme of Teaching and Examination

3rd and 4th Semester Syllabus

INSTITUTION VISION

Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills.

MISSION

To train the students to become Quality Engineers with High Standards of Professionalism and Ethics who have Positive Attitude, a Perfect blend of Techno-Managerial Skills and Problem-solving ability with an analytical and innovative mindset.

QUALITY POLICY

- Imparting value-added technical education with state-of-the-art technology in a congenial, disciplined and a research-oriented environment.
- Fostering cultural, ethical, moral and social values in the human resources of the institution.
- Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education.

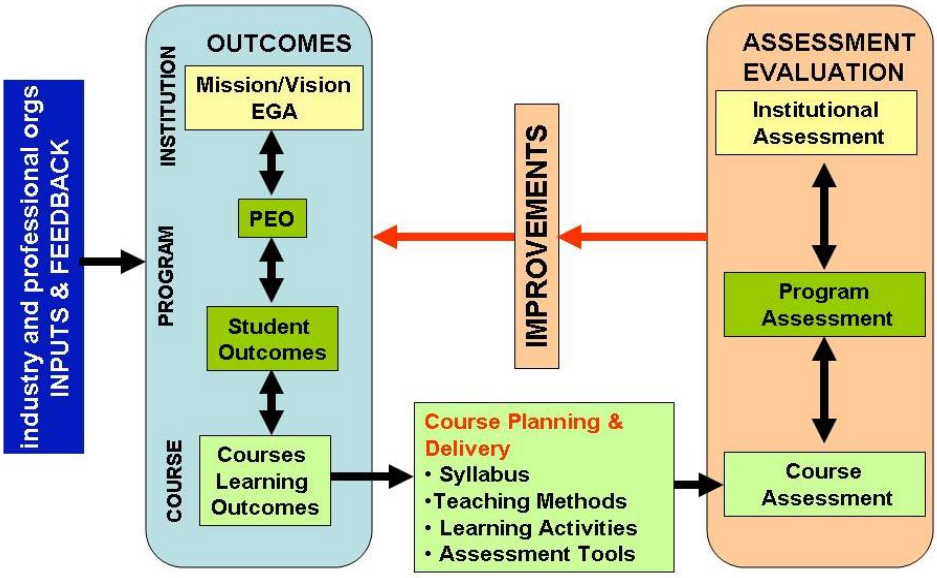
DEPARTMENT VISION

The Electronics & Communication Engineering department shall impart quality technical education and entrepreneurship skills to develop creative individuals to face changing global scenario.

MISSION

To augment the national talent pool, with Electronics and Communication Engineers having all-encompassing technical knowledge, principled practices and nationalistic outlook.

OUTCOME BASED EDUCATION (OBE)



PROGRAM OUTCOMES (POs):

National Board of Accreditation (NBA) has framed the Program Outcomes (PO) based on twelve Graduate Attributes (GA). These POs are generic to engineering education and applies to all branches of Engineering.

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

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

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

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

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

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

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

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

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

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

11. Project management and finance: Demonstrate knowledge and understanding of the engineering 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 lifelong learning in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

1. **The graduates will acquire core competence in basic science and Electronics and Communication Engineering fundamentals necessary to formulate, analyze, and solve engineering problems and to pursue advanced study or research.**
2. **The graduates will engage in the activities that demonstrate desire for ongoing personal and professional growth and self-confidence to adapt to rapid and major changes.**
3. **The graduates will maintain high professionalism and ethical standards, effective oral and written communication skills, work as part of teams on multidisciplinary projects under diverse professional environments, and relate engineering issues to the society, global economy and to emerging technologies.**

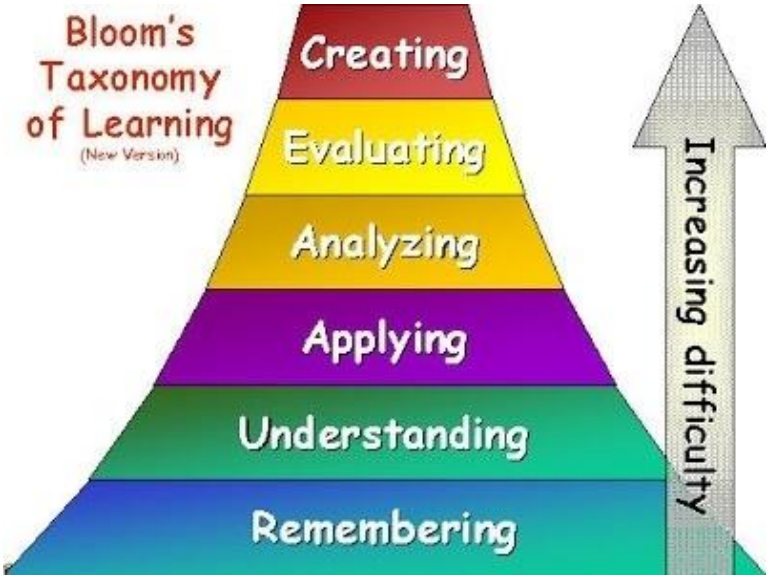
PROGRAM SPECIFIC OUTCOMES (PSOs):

1. **Understanding and applying the mathematical and scientific concepts, for analysis and design of basic Electronics and Communication systems.**
2. **Developing critical thinking abilities coupled with competence in use of computational tools for professional growth; complimented with communication skills and leadership attributes.**
3. **Identifying societal needs and sensitizing individuals towards finding innovative solutions to contemporary issues with multidisciplinary outlook.**

BLOOM'S TAXONOMY OF LEARNING OBJECTIVES

Bloom's Taxonomy in its various forms represents the process of learning. It was developed in 1956 by Benjamin Bloom and modified during the 1990's by a new group of cognitive psychologists, led by Lorin Anderson (a former student of Bloom's) to make it relevant to the 21st century. The **revised taxonomy** given below emphasizes what a learner "Can Do".

Lower order thinking skills (LOTS)		
L1	Remembering	Retrieve relevant knowledge from memory.
L2	Understanding	Construct meaning from instructional material, including oral, written, and graphic communication.
L3	Applying	Carry out or use a procedure in a given situation – using learned knowledge.
Higher order thinking skills (HOTS)		
L4	Analyzing	Break down knowledge into its components and determine the relationships of the components to one another and then how they relate to an overall structure or task.
L5	Evaluating	Make judgments based on criteria and standards, using previously learned knowledge.
L6	Creating	Combining or reorganizing elements to form a coherent or functional whole or into a new pattern, structure or idea.



Scheme of Teaching and Examination- 3rd to 8th Semester B.E.

As per the guidelines of UGC CBCS the courses can be classified into:

i. **Core Courses (PC):** This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirements of a program in a said discipline of study. These courses will have 4 credits per course.

ii. **Foundation Courses:** The Foundation Courses are of two kinds:

   a. Compulsory Foundation (FC): These courses are the courses based upon the content that leads to Knowledge enhancement. These courses provide opportunities to improve technological knowledge before entering industry as well as preparing students for higher degrees in technological subjects. They are mandatory for all disciplines. These courses will have 4 credits per course.

The courses are: **Basic Science Courses (BS), Engineering Science Courses (ES).**

   b. **Foundation Electives (FE):** These are value-based courses aimed at man making education. These courses will have 3 credits per course. The course is related to **Humanities and Social Science Courses.**

iii. **Elective Courses:** This is course, which can be chosen from the pool of papers. It may be supportive to the discipline/ providing extended scope/enabling an exposure to some other discipline / domain / nurturing student proficiency skills. These courses will have 3 credits per course.

An elective may be **Discipline Centric (PE)** or may be chosen from an unrelated discipline. It may be called an **Open Elective (OE).**

Mandatory Non-Credit Courses (MNC): These courses are mandatory for students joining B.E./B.Tech. Program and students have to successfully complete these courses before the completion of degree.

Semester wise distribution of credits for B.E program

Total credits for B.E Program: 175 credits

		Regular batch		**Dip. Lateral entry**	
	Semester	**Credits per Sem**	**Total credits**	**Credits per Sem**	**Total credits**
1st year	1	20	40	----	----
	2	20		----	
2nd year	3	24	48	24	48
	4	24		24	
3rd year	5	24	48	24	48
	6	24		24	
4th year	7	23	39	23	39
	8	16		16	
	Total	**175**	**175**	**135**	**135**

Credit definition:

Lecture (L): One Hour /week – 1 credit
Tutorial (T): Two hour /week – 1 credit
Practicals (P): Two hours /week – 1 credit;

Scheme of Teaching and Examination- 3rd to 8th Semester B.E.

Third Semester (Regular)									
S. No.	**Course Code**	**Course Title**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1.	18MATEC31	Statistical-Numerical – Fourier Techniques	BS	4 – 0 – 0	4	4	50	50	100
2.	18EC32	Analog Electronics	PC1	4 – 0 – 0	4	4	50	50	100
3.	18EC33	Digital Electronics	PC2	4 – 0 – 0	4	4	50	50	100
4.	18EC34	Signals and Systems	PC3	3 – 2 – 0	5	4	50	50	100
5.	18EC35	Network Analysis	PC4	4 – 0 – 0	4	4	50	50	100
6.	18ECL36	Analog Electronics Lab	L1	0 – 0 – 3	3	1.5	25	25	50
7.	18ECL37	Digital Electronics Lab	L2	0 – 0 – 3	3	1.5	25	25	50
8.	18ECL38	Network Analysis Lab	L3	0 – 0 – 2	2	1	25	25	50
9.	18EC39	Environmental Studies	HS	MNC		MNC	25	-	25
		Total			**29**	**24**	**350**	**325**	**675**

Third Semester (Diploma)									
S. No.	**Course Code**	**Course Title**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1.	18DMATEC31	Calculus, Fourier Analysis and Linear Algebra	BS	4 – 0 – 0	4	4	50	50	100
2.	18EC32	Analog Electronics	PC1	4 – 0 – 0	4	4	50	50	100
3.	18EC33	Digital Electronics	PC2	4 – 0 – 0	4	4	50	50	100
4.	18EC34	Signals and Systems	PC3	3 – 2 – 0	5	4	50	50	100
5.	18EC35	Network Analysis	PC4	4 – 0 – 0	4	4	50	50	100
6.	18ECL36	Analog Electronics Lab	L1	0 – 0 – 3	3	1.5	25	25	50
7.	18ECL37	Digital Electronics Lab	L2	0 – 0 – 3	3	1.5	25	25	50
8.	18ECL38	Network Analysis Lab	L3	0 – 0 – 2	2	1	25	25	50
9.	18EC39	Environmental Studies	HS	MNC		MNC	25	-	25
		Total			**29**	**24**	**350**	**325**	**675**

Forth Semester (Regular)									
S. No.	**Course Code**	**Course Title**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1.	18MATEC41	Partial Differential Equations, Sampling Techniques and Transforms	BS	4 – 0 – 0	4	4	50	50	100
2.	18EC42	Microcontrollers	PC1	4 – 0 – 0	4	4	50	50	100
3.	18EC43	Control Systems	PC2	4 – 0 – 0	4	4	50	50	100
4.	18EC44	DSP & Algorithms	PC3	3 – 2 – 0	5	4	50	50	100
5.	18EC45	Communication Theory and Techniques	PC4	4 – 0 – 0	4	4	50	50	100
6.	18ECL46	Microcontrollers Lab	L1	0 – 0 – 2	2	1	25	25	50
7.	18ECL47	Communication Lab	L2	0 – 0 – 2	2	1	25	25	50
8.	18ECL48	Control System Lab	L3	0 – 0 – 2	2	1	25	25	50
9.	18ECB49/ 18ECS49	Balake Kannada/ Sanskrutika Kannada	HS	0 – 2 – 0	2	1	25	25	50
		Total			**30**	**24**	**350**	**350**	**700**

 # MNC: Mandatory Non-credit course. Pass in this course is mandatory for the award of degree.

Fourth Semester (Diploma)									
S. No.	**Course Code**	**Course Title**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1.	18DMATEC41	Vector Calculus, Laplace Transforms and Probability	BS	4 – 0 – 0	4	4	50	50	100
2.	18EC42	Microcontrollers	PC1	4 – 0 – 0	4	4	50	50	100
3.	18EC43	Control Systems	PC2	4 – 0 – 0	4	4	50	50	100
4.	18EC44	DSP & Algorithms	PC3	3 – 2 – 0	5	4	50	50	100
5.	18EC45	Communication Theory and Techniques	PC4	4 – 0 – 0	4	4	50	50	100
6.	18ECL46	Microcontrollers Lab	L1	0 – 0 – 2	2	1	25	25	50
7.	18ECL47	Communication Lab	L2	0 – 0 – 2	2	1	25	25	50
8.	18ECL48	Control System Lab	L3	0 – 0 – 2	2	1	25	25	50
9.	18ECB49/ 18ECS49	Balake Kannada/ Sanskrutika Kannada	HS	0 – 2 – 0	2	1	25	25	50
		Total			**30**	**24**	**350**	**350**	**700**

Fifth Semester (Regular)									
S. No.	**Course Code**	**Course Title**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1.	18EC51	Operating System**	PC1	3 – 2 – 0	5	4	50	50	100
2.	18EC52	CMOS VLSI Design	PC2	4 – 0 – 0	4	4	50	50	100
3.	18EC53	Information Theory and Digital Communication	PC3	4 – 0 – 0	4	4	50	50	100
4.	18EC54	Engineering Electromagnetics	PC4	3 – 2 – 0	5	4	50	50	100
5.	18EC55X	Professional Elective-I	PE	3 – 0 – 0	3	3	50	50	100
6.	**18EC56X**	**Open Elective – I Or Institute Elective**	OE	3 – 0 – 0	3	3	50	50	100
7.	18ECL57	VLSI Lab	L1	0 – 0 – 2	2	1	25	25	50
8.	18ECL58	Information Theory and Digital Communication Lab	L2	0 – 0 – 2	2	1	25	25	50
9.	18EC59A	Employability Skills – I	MNC	3 – 0 – 0	3	MNC	50	-	50
		Total			**31**	**24**	**400**	**350**	**750**

**** One Course of 4 credits exempted in 5thsemesterfor Diploma lateral entry students to maintain the same credits as regular.**

Operating System has been exempted.

Course Code	Professional Elective – I
18EC551	Power Electronics
18EC552	System Modeling
18EC553	Speech Processing
18EC554	Artificial Neural Networks
18EC555	Cryptography and Network Security

Course Code	Open Elective – I
18EC561	Consumer Electronics
18EC562	Fuzzy Logic and Applications
18EC563	Heterogeneous Computing
18EC564	Requirements Engineering
18INT51 (Institute Elective)	**Biomedical Image Understanding and Analysis**

<u>Note:</u> Open Elective (OE) courses are offered to other branch students.

****However, institute elective can be opted by ECE students.**

Fifth Semester (Diploma)									
S. No.	**Course Code**	**Course Title**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1.	18DMATEC51	Partial Differential Equations, Z – Transforms and Stochastic Processes	BS	4 – 0 – 0	4	4	50	50	100
2.	18EC52	CMOS VLSI Design	PC1	4 – 0 – 0	4	4	50	50	100
3.	18EC53	Information Theory and Digital Communication	PC3	4 – 0 – 0	4	4	50	50	100
4.	18EC54	Engineering Electromagnetics	PC2	3 – 2 – 0	5	4	50	50	100
5.	18EC55X	Professional Elective-I	PE	3 – 0 – 0	3	3	50	50	100
6.	**18EC56X**	**Open Elective – I Or Institute Elective**	OE	3 – 0 – 0	3	3	50	50	100
7.	18ECL57	VLSI Lab	L1	0 – 0 – 2	2	1	25	25	50
8.	18ECL58	Information Theory and Digital Communication Lab	L2	0 – 0 – 2	2	1	25	25	50
9.	18EC59A	Employability Skills – I	MNC	3 – 0 – 0	3	MNC	50	-	50
10.	**18EC59B**	Communicative English	HS	1 – 0 – 1	2	MNC	25	-	25
		Total			**32**	**24**	**425**	**350**	**775**

**** One Course of 4 credits exempted in 5thsemester for Diploma lateral entry students to maintain the same credits as regular.**

Operating System has been exempted.

Course Code	**Professional Elective – I**
18EC551	Power Electronics
18EC552	System Modeling
18EC553	Speech Processing
18EC554	Artificial Neural Networks
18EC555	Cryptography and Network Security

Course Code	**Open Elective – I**
18EC561	Consumer Electronics
18EC562	Fuzzy Logic and Applications
18EC563	Heterogeneous Computing
18EC564	Requirements Engineering
18INT51 (Institute Elective)	**Biomedical Image Understanding and Analysis**

*****However, institute elective can be opted by ECE students.**

Sixth Semester									
S. No.	**Course Code**	**Course Title**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1.	18EC61	Image Processing and Computer Vision	PC1	3 – 2 – 0	5	4	50	50	100
2.	18EC62	Computer Communication Networks	PC2	4 – 0 – 0	4	4	50	50	100
3.	18EC63	Sensors and Signal Conditioning	PC3	3 – 2 – 0	5	4	50	50	100
4.	18EC64X	Professional Elective-II	PE	3 – 0 – 0	3	3	50	50	100
5.	18EC65X	Professional Elective-III	PE	3 – 0 – 0	3	3	50	50	100
6.	**18EC66X**	**Open Elective - II**	OE	3 – 0 – 0	3	3	50	50	100
7.	18ECL67	Advanced C and C++ Lab	L1	0 – 0 – 2	2	1	25	25	50
8.	18ECL68	Networking Lab	L2	0 – 0 – 2	2	1	25	25	50
9.	18EC69A	Constitution of India, PE and HV	HS	1 – 0 – 0	1	1	25	25	50
10.	18EC69B	Employability Skills – II	MNC	3 – 0 – 0	3	MNC	50	-	50
		Total			**31**	**24**	**425**	**375**	**800**

Course Code	**Professional Elective – II**
18EC641	Requirements Engineering
18EC642	Virtual Instrumentation
18EC643	Machine Learning
18EC644	Robotics & Automation
18EC645	Data Base Management System

Course Code	**Professional Elective – III**
18EC651	Digital Forensics
18EC652	Biomedical System Design
18EC653	Heterogeneous Computing
18EC654	Remote Sensing and GIS
18EC655	Human Computer Interaction
18EC656	Electric and Hybrid Vehicles

Course Code	**Open Elective - II**
18EC661	Nano Electronics
18EC662	Artificial Neural Networks
18EC663	Embedded System Design
18EC664	IoE

Seventh Semester									
S. No.	**Code**	**Course Title**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1.	18EC71	Management and Entrepreneurship With Branch specific case studies	HS	3 – 0 – 0	3	3	50	50	100
2.	18EC72	Microwave and Antenna Engineering	PC1	3 – 0 – 0	3	3	50	50	100
3.	18EC73	Wireless and Mobile Communication	PC2	3 – 0 – 0	3	3	50	50	100
4.	18EC74X	Professional Elective-IV	PE	3 – 0 – 0	3	3	50	50	100
5.	18EC75X	Professional Elective-V	PE	3 – 0 – 0	3	3	50	50	100
6.	**18EC76X**	**Open Elective - III**	OE	3 – 0 – 0	3	3	50	50	100
7.	18ECL77	Microwave and Antenna Lab	L1	0 – 0 – 3	3	1.5	25	25	50
8.	18ECL78	Wireless and Mobile Communication Lab	L2	0 – 0 – 3	3	1.5	25	25	50
9.	18EC79	**Seminar on Project synopsis (Design Thinking Approach) Project Phase -1**	**PC**	0 – 0 – 2	2	2	25	--	25
		Total			**26**	**23**	**375**	**350**	**725**

Project Phase -1: CIE- 25 marks (Average of 25 marks –Internal guide and 25 marks- presentation)

Course Code	Professional Elective – IV
18EC741	ASIC Design
18EC742	Analog Mixed Mode VLSI
18EC743	Electronic System Design
18EC744	RF System Design
18EC745	Deep Learning

Course Code	Professional Elective – V
18EC751	Low Power VLSI
18EC752	Multimedia Communication
18EC753	IoT
18EC754	Wireless Ad Hoc and Sensor Networks
18EC755	Data Analytics for Wearable Technology
18EC756	Salesforce Lightning (Integrated)
18EC757	AWS Cloud Computing (Integrated)

Course Code	Open Elective – III
18EC761	Sensors and Signal Conditioning
18EC762	Multimedia Processing
18EC763	System Modeling
18EC764	Digital Forensics
18EC765	Biomedical System Design
18EC766	Electric and Hybrid Vehicles

Eight Semester									
S. No.	**Code**	**Course Title**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1.	18EC81	Internship	PC			2	50	--	50
2.	18EC82	Intellectual Property Rights	HS	Self-Study		1	50		50
3.	18EC83	Professional Certification – 1(English / any other foreign language)	HS			1	25	--	25
4.	18EC84	Professional Certification – 2	PC			1	25	--	25
5.	18EC85	Project Phase – 2	PC			2	50(25+25)	--	50
6.	18EC86	Project Phase – 3	PC			4	50(25+25)	--	50
7.	18EC87	Project Phase – 4(Final Viva Voce)	PC	Final		5	--	100	100
						16	**250**	**100**	**350**

Internship: 6 to 8 weeks duration

Project Phase -2 and 3: CIE- 50 marks (25 marks –Internal guide + 25 marks- presentation)

Third Semester
Statistical – Numerical – Fourier Techniques
(Regular Common to all branches)

Course Code	18MATEC31	**Credits**	4
Course type	BS	**CIE Marks**	50
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives (CLO's):

1. Learn Numerical methods to solve Algebraic, Transcendental and Ordinary Differential Equations.
2. Understand the concept of Fourier series and apply when needed.
3. Get acquainted with Fourier Transforms and its properties.
4. Study the concept of Random variables and its applications.
5. Get acquainted with Joint Probability Distribution and Stochastic processes.

Pre-requisites:

1. Basic Differentiation and Integration
2. Basic Probability
3. Basic Statistics

Unit – I **10 Hours**

Numerical solution of Algebraic and Transcendental equations:
Method of False position, Newton- Raphson method (with derivation), Fixed point iteration method (without derivation).
Numerical solution of Ordinary differential equations: Taylor's Series method, Euler and Modified Euler method, Fourth order Runge–Kutta method

Unit - II **10 Hours**

Fourier Series: Periodic functions. Dirichlet's conditions, Fourier series, Half range Fourier sine and cosine series. Practical examples, Harmonic analysis.

Unit - III **10 Hours**

Fourier Transforms: Infinite Fourier Transform and Properties. Fourier Sine and Cosine Transforms Properties and Problems.

Unit - IV **10 Hours**

Probability: Random Variables (RV), Discrete and Continuous Random variables, (DRV, CRV) Probability Distribution Functions (PDF) and Cumulative Distribution Functions

(CDF), Expectations (Mean, Variance). Binomial, Poisson, Exponential and Normal Distributions. Practical examples.

Unit - V **10 Hours**

Joint PDF and Stochastic Processes: Discrete Joint PDF, Conditional Joint PDF, Expectations (Mean, Variance and Covariance). Definition and classification of stochastic processes. Discrete state and discrete parameter stochastic process, Unique fixed probability vector, Regular Stochastic Matrix, Transition probability, Markov chain.

Books:

Text Books:

1. B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
2. Erwin Kreyszig –Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006.
3. B. V. Ramana- Higher Engineering Mathematics, Tata McGraw-Hill Education Private Limited, Tenth reprint 2010 and onwards.

Reference Books:

1. P. N. Wartikar & J. N. Wartikar– Applied Mathematics (Volume I and II) Pune Vidyarthi Griha Prakashan, 7th Edition 1994.
2. Peter V. O' Neil – Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition, 2011.
3. Glyn James – Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Use** Numerical methods and **Solve** Algebraic, Transcendental and Ordinary differential equations.	**[L2]**
2.	**Develop** frequency bond series from time bond functions using Fourier series.	**[L2]**
3.	**Understand** Fourier Transforms and its properties.	**[L2]**
4.	**Understand** the concept of Random variables, PDF, CDF and its applications	**[L2]**
5.	**Extend** the basic probability concept to Joint Probability Distribution, Stochastic processes.	**[L3]**
6.	**Apply** Joint Probability Distribution, Stochastic processes to solve relevant problems.	**[L3]**

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	**[PO1]**

2. **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. **[PO2]**
3. **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. **[PO5]**

Course delivery methods

1. Black Board Teaching
2. Power Point Presentation
3. **Scilab/MATLAB/ R-Software/Geogebra**

Assessment methods

1. Internal Assessment
2. Assignment
3. Quiz

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments /MATLAB/Scilab activity	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE: 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Calculus, Fourier Analysis and Linear Algebra

(Lateral Entry All Branches)

Course Code	18DMATEC31	**Credits**	4
Course type	BS	**CIE Marks**	50 marks
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course learning objectives (CLOs):

1. Learn the concept of series expansion using Taylor's and Maclaurin's series and get acquainted with the polar curves and partial differentiation.
2. Learn Differential Equations of first order and higher order and apply them.
3. Get acquainted with Fourier transforms and its properties.
4. Learn numerical methods to solve algebraic, transcendental and ordinary differential equations.
5. Understand and interpret the system of equations and various solutions.

Pre-requisites:

1. Basic differentiation and integration
2. Trigonometry
3. Matrix and determinant operations
4. Vector algebra

Unit – I **10 Hours**

Differential Calculus: Taylor's and Maclaurin's theorems for function of one variable (statement only)-problems. Angle between polar curves. **Partial Differentiation:** Definition and problems. Total differentiation- problems. Partial differentiation of composite functions-problems.

Unit – II **10 Hours**

Laplace Transforms: Definition, Laplace transforms of elementary functions. Laplace transforms of $e^{at}f(t)$, $t^n f(t)$, $\int_0^t f(t)dt$, $\frac{f(t)}{t}$ (without proof), Inverse Laplace transforms: Inverse Laplace transforms -problems, applications to solve linear differential equation.

Unit – III **10 Hours**

Fourier Analysis: Fourier Series: Fourier series, half range Fourier sine and cosine series. Practical examples. Harmonic analysis.

Fourier Transforms: Infinite Fourier transform and properties. Fourier sine and cosine transforms. Properties and problems.

Unit – IV **10 Hours**

Numerical Techniques: Numerical solution of algebraic and transcendental equations: Method of false position, Newton- Raphson method, fixed point iteration method (without derivation).

Numerical solution of ordinary differential equations: Taylor's series method, Euler and modified Euler method, fourth order Runge-Kutta method (without derivation).

Unit – V **10 Hours**

Linear Algebra: Rank of a matrix by elementary transformation, solution of system of linear equations-Gauss elimination method and Gauss-Seidal method. Eigen value and eigen vectors – Rayleigh's Power method.

Books

Text Books:

1. B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012 and onwards.
2. Erwin Kreyszig –Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006 and onwards.
3. B. V. Ramana - Higher Engineering Mathematics, Tata McGraw-Hill Education Private Limited, Tenth reprint 2010 and onwards.

Reference Books:

1. P. N. Wartikar & J. N. Wartikar – Applied Mathematics (Volume I and II) Pune Vidyarthi Griha Prakashan, 7th Edition 1994 and onwards.
2. Peter V. O' Neil –Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition, 2011 and onwards.
3. Glyn James –Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010 and onwards.

Course Outcome (COs)

At the end of the course, the student will be able to		**Bloom's Level**
1.	**Develop** the Taylors and Maclaurins series using derivative concept.	**[L1, L2]**
2.	**Demonstrate** the concept and use of Partial Differentiation in various problems.	**[L1, L2]**

3. **Classify** Laplace transforms of various categories and **apply** them to solve relevant problems**.** **[L1, L3]**

4. **Develop** frequency bond series from time bond functions using Fourier series. **[L3]**

5. **Use** numerical methods and **Solve** algebraic, transcendental and ordinary differential equations **[L1, L2]**

6. **Interpret** the various solutions of system of equations and **Solve them.** **[L2]**

Program Outcome of this course (POs)

		PO No.
1.	**Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	**[PO1]**
2.	**Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	**[PO2]**
3.	**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.	**[PO5]**

Course delivery methods	**Assessment methods**
1. Black Board Teaching	1. Internal Assessment
2. Power Point Presentation	2. Assignment
3. **Scilab/MATLAB/ R-Software/Geogebra**	3. Quiz

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments /MATLAB/Scilab activity	Quiz/Seminar/Course Project	Total Marks
Maximum marks:50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE: 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Analog Electronics

Course Code	18EC32	**Credits**	4
Course type	PC1	**CIE Marks**	50 marks
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course learning objectives (CLOs):

1. Study basic semiconductor diode parameters and equivalent circuits. Design circuit applications that involve diodes such as clippers, clampers etc.
2. Explore into various transistor bias configurations; formulate expressions to establish the location of the quiescent point; describe methods for further maintaining the quiescent point stable.
3. Study the ac operation of the transistor at low and high frequencies via transistor modeling for all three configuration types.
4. Explain the construction and operation of JFETs and MOSFETs. Look into the various biasing techniques.
5. Study the operation of FETs via small signal modeling and further apply it to design FET amplifier networks.

Pre-requisites:

1. Basic Electrical and Electronics Engineering (18ELE13/18ELE23)

Unit - I **10 Hours**

Semiconductor Diode and Applications*:* Diode Resistance and Capacitances, Diode equivalent circuits, practical Vs ideal diode, Rectifiers and filters.

Case study:

Design of DC Power supply
Design of wave shaping circuits
Design of DC restorer circuits

Unit - II **10 Hours**

Transistor Biasing*:* Operating point, Fixed bias circuit, Emitter stabilized biased circuits, Voltage divider bias, DC bias with voltage feedback, Bias stabilization.

Case study:

Design of voltage divider bias as applied to amplifier.
Study of variation of Q-pt. for voltage divider bias circuit.

Unit - III **10 Hours**

BJT AC Analysis*:* BJT transistor modeling, Hybrid equivalent model, r_e transistor model, Hybrid pi model, cascaded systems.

Case study:

AC analysis of transistor circuits using h parameter and r_e transistor model for Darlington connection.

Unit - IV **10 Hours**

Field Effect Transistors: Introduction, Construction, basic operation and characteristics of: JFET, Depletion-type MOSFET, Enhancement-type MOSFET, CMOS technology.

FET Biasing: Introduction, Fixed biased circuit for FETs, Voltage divider bias

Case study:

Design of FET fixed bias circuits for given Q-pt.

Unit - V **10 Hours**

FET Amplifiers: Introduction, FET small signal model, Depletion-type MOSFET ac equivalent model, Enhancement type FET ac equivalent model, Comparison of BJT and FET.

Case study:

AC analysis of common source FET Amplifier circuit.

Books

Text Books:

1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", PHI/Pearson Education, 9th Edition and onwards.
2. Jacob Millman & Christos C. Halkias, "Integrated Electronics", Tata-McGraw Hill, 2nd Edition, 2010 and onwards.
3. David A. Bell, "Electronic Devices and Circuits", PHI, 4th Edition, 2004 and onwards.

Reference Books:

1. A. S. Sedra & K. C. Smith, "Microelectronic Circuits", Oxford Univ. Press, 5th Edition, 1999 and onwards.
2. Thomas L. Floyd, "Electronic devices", Pearson Education, 2002 and onwards.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Develop and employ circuit models for elementary electronic components, e.g. diodes.	L3
2. Infer the terminal behavior of the devices such as diode, BJT & FETs, also identify the region of operation with its equivalent circuit model.	L3
3. Develop the capability to analyze and design simple circuits containing elements such as BJTs and FETs using the concepts of load lines, operating points and device modeling.	L4
4. Identify the need for small signal operation and evaluate the small signal model and the performance parameters of the device.	L3

Program Outcome of this course (POs)	PO No.
1. **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	**1**
2. **Problem Analysis:** Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	**2**
3. **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.	**3**
4. **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.	**5**

Course delivery methods	Assessment methods
1. Classroom Teaching (Blackboard)	1. IA test

2. Presentation
3. Simulations

2. Assignment
3. Quiz
4. Activity

CIE and SEE Pattern:

Theory courses having 4 – 0 – 0 / 3 – 0 – 0 distribution:

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE: 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Digital Electronics

Course Code	18EC33	**Credits**	4
Course type	PC2	**CIE Marks**	50 marks
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course learning objectives (CLOs):

1. To study the Boolean minimization technique applied to digital circuits.
2. To gain knowledge in the design of combination circuits.
3. To acquaint with the design of sequential circuits through the fundamentals of flip-flops.
4. To understand the design of sequential circuits using finite state machine diagram.
5. To model the digital circuits using Verilog HDL programming.

Pre-requisites:

1. Basic Electrical and Electronics Engineering (18ELE13/18ELE23)

Unit - I **10 Hours**

Fundamentals of Digital Design: Karnaugh maps- 3 and 4 variables, Simplification of Completely and Incompletely specified Boolean functions, Realization of Boolean functions (using basic gates, using universal gates). Introduction to Verilog HDL Programming - data types, programming styles: data flow, behavioral, structural.

Case Study: Designing logic circuits to control operations for industrial applications using gates and their implementation using Verilog HDL.

Unit - II **10 Hours**

Design of Combinational Circuits – I: Analysis & design of-Encoders, Decoders, Multiplexers, Demultiplexers.

HDL programming using behavioral description, with basic coding structures (if- else, case, conditional statements etc.)

Case Study: Designing logic circuits to control operations for industrial applications using MSI components and their implementation using Verilog HDL.

Unit - III **10 Hours**

Design of Combinational Circuits – II: Design of Parallel Adder, Fast Adder, Adder/Subtractor, and Comparator

HDL programming using behavioral description, with basic coding structures and advanced structure (Task and Generate)

Case Study: Designing logic circuits to control operations for industrial applications using MSI components and their implementation using Verilog HDL.

Unit – IV **10 Hours**

Flip-Flops: Basic bi-stable element, Latches, The gated latches, Master-Slave Flip-Flops, Edge triggered flip-flops, and Characteristic Equations, Conversion of Flip-Flops.

Verilog HDL implementation of Flip-Flops.

Case Study: Applications involving flip-flops and their implementation using Verilog HDL.

Unit – V **10 Hours**

Design of Sequential Logic Circuits: Asynchronous counters. Design of Synchronous counters, Shift Register (SISO, PIPO, SIPO, PISO) and its application (ring and Johnson counter), Universal shift register, Introduction to FSM - Mealy and Moore models
Verilog HDL implementation of Counters and Shift Registers
Case Study: Applications involving Counters and Registers and their implementation using Verilog HDL.

Books

Text Books:

1. Donald P Leach, Albert Paul Malvino, and Goutam Saha, "Digital Principles and Applications", 7th Edition, TMH.
2. Donald D. Givone, "Digital Principles and Design", McGraw-Hill, 1st Edition, 2002.

Reference Books:

1. John M Yarbrough, "Digital Logic Application and Design", Thomas Learning, 2001.
2. Nazeih M Botros, "HDL Programming VHDL and VERILOG Charles River Media Inc. USA 2009.
3. Stephen Brown, "Fundamentals of Digital Logic with Verilog Design", 3rd Edition, TMH New Delhi.

E-resources (NPTEL/SWAYAM, Any Other)

1. NPTEL
2. Swayam

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Define and explain the fundamentals of digital electronics and apply the knowledge of K-map simplification in the reduction of redundant logic in a given logic circuit.	L3
2. Apply the knowledge of digital electronics concept to design optimal digital circuits for the given specifications	L3
3. Analyze and design digital circuits and arrive at conclusion.	L3
4. To design experiments for given application or real situation problem	L4
5. To engage in self-study to formulate, design, implement analyze, and demonstrate an application in digital circuits.	L5

Program Outcome of this course (POs)	PO No.
1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	**1**
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	**2**
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.	**3**

Course delivery methods	**Assessment methods**
1. Classroom teaching using Blackboard	1. Internal assessment tests
2. Classroom teaching using PPTs	2. Assignments

3.	Demo of Verilog HDL Implementations using Xilinx	3. 4. 5.	Course activities like miniprojects, seminars, survey, case studies. Quizes Classroom performance

CIE and SEE Pattern:

Theory courses having 4 – 0 – 0 / 3 – 0 – 0 distribution:

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE: 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Signals and Systems

Course Code	18EC34	**Credits**	4
Course type	PC3	**CIE Marks**	50
Hours/week: L – T – P	3 – 2 – 0	**SEE Marks**	50
Total Hours:	50	**SEE Duration**	3 Hours

Course Learning Objectives (CLOs):

1. To Understand the fundamental characteristics of signals and systems.
2. To Learn to solve problems involving convolution.
3. To study the representation of LTI systems using differential equations.
4. To appreciate the use of Z-transforms in system representation.
5. To Learn to transform the time domain signal into frequency domain and study the sampling theorem.

Pre-requisites:

1. Engineering Mathematics (18MAT11/18MAT21)

Unit – I **10 Hours**

Introduction: Definitions of a signal and a system, Classification of signals, Basic Operations on signals, Elementary signals, Systems viewed as Interconnections of operations, Properties of systems.

Tutorial / Case Study:

1. Simulation of composite signal generation, scaling and shifting of signals
2. Study of the signal properties using hardware.

Unit – II **10 Hours**

Time-domain representations for LTI systems – I: Convolution, impulse response representation, Convolution Sum and Convolution Integral.

Tutorial / Case Study:

1. Demonstration of convolution of signals.
2. Mixing of audio/image signals.

Unit – III **10 Hours**

Time-domain representations for LTI systems – II: Properties of impulse response representation, Differential and difference equation Representations, Block diagram representations.

Tutorial / Case Study: Solution of differential/ difference equations.

Unit – IV **10 Hours**

Z – Transforms: Introduction, Z – transform, properties of ROC, properties of Z – transforms, Inversion of Z transforms (Derivation of IZT using Contour integration): Transform analysis of LTI Systems.

Tutorial / Case Study: Unilateral Z – Transform and its application to solve difference equations.

Unit - V **10 Hours**

Fourier representation for signals: Discrete and continuous Fourier transforms and their properties, Sampling theory in time and frequency domain and Nyquist Criterion.

Tutorial / Case Study: Study of signals in time domain and frequency domain using Fourier analysis.

Text Books

1. Simon Haykin and Barry Van Veen, "Signals and Systems", John Wiley & Sons, 2001, Reprint 2002 and onwards.

Reference Books

1. Alan V. Oppenheim, Alan S. Willsky and A Hamid Nawab, "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002 and onwards**.**
2. H. P Hsu, R. Ranjan, "Signals and Systems", Schaum's outline, TMH, 2006 and onwards.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Classify signals and systems and apply basic operations on signals.	L3
2. Classify systems based on their properties and determine the response of LTI system using Convolution.	L3
3. Analyze the systems using Differential and Difference equations.	L3
4. Analyze system properties based on impulse response and Fourier Transforms.	L3
5. Apply the Z- transform to analyze discrete-time signals and systems.	L3

Program Outcome of this course (POs)	PO No.
1. **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	1
2. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.	4
3. **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.	5

Course delivery methods

1. Classroom Teaching (Blackboard)
2. Presentation
3. Simulations
4. Videos

Assessment methods

1. IA test
2. Assignment
3. Quiz
4. Activity

CIE and SEE Pattern:

Theory courses having 4 – 0 – 0 / 3 – 0 – 0 distribution:

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory.				

Minimum marks required to qualify for SEE: 20 out of 50 marks

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Network Analysis

Course Code	18EC35	**Credits**	4
Course type	PC4	**CIE Marks**	50 marks
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50 marks
Total Hours	50	**SEE Duration**	3 Hours for 100 marks

Course learning objectives (CLOs):

1. To understand DC and AC circuit analysis using KCL, KVL, Mesh, and Node analysis.
2. To study basic network theorems like Superposition, Maximum Power Transfer, Thevenin's and Norton's etc.
3. To study two port networks, and open circuit, short circuit, transmission and hybrid parameters related to it.
4. To understand the concept of resonance and study basic parameters related to series and parallel resonance.
5. To analyze transient and steady state response of combinations of R-L-C circuit elements with DC excitation [time domain analysis only].

Pre-requisites: Basic Electrical and Electronics Engineering (18ELE13/18ELE23)

Unit - I **10 Hours**

Basics of Network Analysis – Practical voltage and current sources, circuit analysis by source transformation, KCL, KVL, mesh and node analysis for networks with DC and AC sources, concept of super-mesh and super-node and related numerical.

Case Study: Study of standard measuring instruments - CRO (2 different make), function generator (2 different make), analog multimeter, digital multimeter, DC power supply (single and dual supply & current source study) – with manual from Lab.

Unit - II **10 Hours**

Basic Network Theorems – Superposition theorem, Maximum power transfer theorem, Thevenin's theorem, Norton's theorem – statements, explanation and numerical with independent and dependent sources.

Case Studies:

i. Demonstration of maximum power transfer theorem with AC source and RLC network both at source and at load.
ii. Demonstrate the superposition of DC voltage and low frequency AC at the output of an amplifier.

Unit - III **10 Hours**

Two Port Networks – Basics equation and significance of Z parameter, Y parameter, T parameter, and h parameter and with relevant numerical [only with independent source - deal numerical with Star-Delta networks as well]. Conversion of Z into Y parameter and vice versa (with proof). Concept of reciprocity and symmetry. Interconnection of series, parallel, series-parallel, and cascaded circuits.

Case Studies:

i. Cascading of amplifiers and related applications.
ii. Transmission line model $\alpha - \beta - \gamma$ parameters, scattering (S) parameters, standing wave, reflection coefficient, & impedance matching.

Unit - IV **10 Hours**

Resonance – Introduction, Q-factor, cut-off frequency, bandwidth graph, selectivity, series and parallel RLC resonance circuits and related numerical.

Case Studies:

i. Resonant circuit as filter – highlight the fundamentals like bandwidth, selectivity, half power frequency, pass band, attenuation band etc.
ii. Evolution of Radio and TV tuner – starting from analog till present day digital tuner. Function of resonance in tuner.
iii. Evolution of Oscillator – basic criterion for oscillation, transistor based and op-amp based oscillator circuits, crystal oscillator – application and comparison of crystal oscillators in latest mobile phones, computers, and laptop.

Unit - V **10 Hours**

Transients – Behavior of basic circuit elements at transient and steady state with DC excitation, transient response of circuits with series and parallel combinations of R, L, and C with DC excitation [only time domain analysis is to be done].

Case Study: Simulation of circuit response under switching conditions [DC response to be demonstrated and studied with numerical computational software].

Books

Text Books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice-Hall, 3rd Edition, ISBN: 9789332550131, 9332550131, 2015.
2. A. Sudhakar and S. P. Shyammohan, "Circuits and Networks, Analysis and Synthesis", Tata McGraw Hill Limited, 2017, 3rd Edition.
3. Mahmood Nahvi, and Joseph A. Edminister, "Schaum's Outlines Series: Electric Circuits", McGraw Hill Limited, 4th Edition, 0-07-142582-9, 2003.
4. William J. Hayt Jr. and J. E. Kemmerly, "Engineering Circuit Analysis", Tata McGraw Hill Limited, 2nd Edition. 5th Edition.

Reference Books:

1. D. Roy Choudhury, "Networks and Systems", New Age International, 1st edition, 1998.
2. Franklin Kuo, "Network Analysis and Synthesis", 2nd edition, Wiley International, 2008.
3. John O'Malley, "Schaum's Outlines Series of Theory and Problems on Basic Circuit Analysis", McGraw Hill Limited, 5th Edition.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	*Discuss* the application of Mesh and Node analysis to DC and AC circuits	L3
2.	*Apply* the knowledge of Network theorems in circuit simplification and analysis	L4
3.	*Synthesize* interconnected two-port networks and determination of its network parameters	L5
4.	*Compare* the resonance phenomena in RLC circuits	L4
5.	*Synthesize* RLC circuits from the given transient behavior or from the given system response	L5

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	1

2.	**Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	2
3.	**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.	5
4.	**Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.	12

Course delivery methods

1. Classroom teaching (blackboard)
2. Presentations
3. Video presentations

Assessment methods

1. IA tests
2. Assignments
3. Quiz
4. Activity

CIE and SEE Pattern:

Theory courses having 4 – 0 – 0 / 3 – 0 – 0 distribution:

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE: 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Analog Electronics Lab

Course Code	18ECL36	**Credits**	1.5
Course type	L1	**CIE Marks**	25 marks
Hours/week: L-T-P	0 – 0 – 3	**SEE Marks**	25 marks
Total Hours:	36	**SEE Duration**	3 Hours/2 Hours for 50 marks

Course learning objectives (CLOs):

1. To provide hands-on experience in the design, analysis, testing, and comprehension of electronic circuits comprising of diodes, BJTs and FETs.
2. To introduce principles of circuit design for practical applications.
3. To identify the significance and inter-dependency of the circuit elements for each circuit application.
4. To design and verify the expected outcomes as per the given specifications.

Pre-requisites: Basic Electrical and Electronics Laboratory (18EEL16/18EEL26)

List of experiments:

1. Half wave rectifier circuit with and without Capacitive filter.
2. Full wave bridge rectifier circuit with and without Capacitive filter.
3. Clipping Circuits.
4. Clamping Circuits.
5. BJT biasing circuits.
6. BJT RC coupled amplifier.
7. Darlington connection.
8. Characteristics of JFET.
9. Characteristics of MOSFET.
10. FET amplifier.

Books

1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", PHI/Pearson Education, 9th Edition and onwards.
2. David A. Bell, "Electronic Devices and Circuits", PHI, 4th Edition, 2004and onwards.

Reference Books

1. Jacob Millman & Christos C. Halkias, "Integrated Electronics", Tata-McGraw Hill, 2nd Edition, 2010and onwards.
2. Thomas L. Floyd, "Electronic devices", Pearson Education, 2002and onwards.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Emphasize diode rectifier fundamentals and justify the importance of capacitor in rectification process	L3
2. Demonstrate diode applications such as clippers and clampers, design, analyze and explain its working	L3
3. Design and study the Q point variation of various biasing circuits.	L3
4. Analyze the frequency response of BJT amplifier circuits.	L3
5. Demonstrate the DC and AC characteristics of FETs.	L3

	Program Outcome of this course (POs)	PO No.
1.	**Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	2
3.	**Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.	3
4.	**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.	5
5.	**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.	10
6.	**Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.	12

Assessment methods

1. Internal Test
2. Quiz
3. Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	Attendance/conduct of lab	Journal	Lab project	Total Marks
Maximum marks :25	10	10	5	25
Submission and certification of journal is compulsory to qualify for SEE Minimum marks required to qualify for SEE: 10 out of 25 marks				

Semester End Examination (SEE):

1.	It will be conducted for 50 marks having 3 hours/2 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted. In case, there are two parts then one experiment from each part.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiment(s), result and conclusion	20 marks	
	One marks question	10 marks	
	Viva-voce	10 marks	
4.	Viva voce is conducted for individual student and not in group		
5.	Minimum passing marks to be scored in SEE: 20 out of 50 marks		

Digital Electronics Lab

Course Code	18ECL37	**Credits**	1.5
Course type	L2	**CIE Marks**	25 marks
Hours/week: L-T-P	0 – 0 – 3	**SEE Marks**	25 marks
Total Hours:	36 Hours	**SEE Duration**	3 Hours for 50 marks

Course learning objectives (CLOs):

1. Verify the fundamental digital circuits using TTL IC's.
2. Design and implement Combinational Logic Circuits.
3. Design and implement Sequential Circuits.
4. Simulation and synthesis of combinational and sequential circuits using Xilinx ISE.

Pre-requisites:

Basic Electrical and Electronics Engineering (18ELE13/18ELE23)

List of experiments

PART – 1

Hardware Experiments on:

1. Adders and Subtractors
2. Multiplexers and de-multiplexers (Decoders)
3. Encoders, Comparators
4. Flip-flops
5. Shift registers
6. Synchronous counters

PART – 2

Verilog Implementation of:

1. Adders and subtractors with all modeling styles.
2. Encoders, Multiplexers and Demultiplexers (Decoder), Comparator
3. Flip-Flops
4. Universal shift register.
5. n-bit Counter.

Books

1. Donald P Leach, Albert Paul Malvino, and Goutam Saha, "Digital Principles and Applications", 7th Edition, TMH.
2. Donald D. Givone, "Digital Principles and Design", McGraw-Hill, 1st Edition, 2002.
3. John M Yarbrough, "Digital Logic Application and Design", Thomas Learning, 2001
4. Nazeil Botros, "*HDL* Programming *VHDL* and Verilog", Dreamtech Press, 2009.
5. Stephen Brown, "Fundamentals of Digital Logic with Verilog Design", 3rd Edition, TMH New Delhi

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Interpret data from IC data sheets and apply the same to build digital circuits**.**	L3
2. To design digital circuits and verify using digital IC Trainer kit**.**	L3
3. To analyze, design and implement logical problems to meet given specifications.	L3

4.	To measure and record the experimental data, analyze the results and prepare a formal laboratory report	L3
5.	To engage in **self-study** to formulate, design, implement, analyze and demonstrate an application of digital electronic circuits through an **open-ended experiment.**	L4
6.	Write the Verilog HDL code and analyze the functionality for the given hardware design through programming.	L6

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	**1**
2.	**Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	**2**
3.	**Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.	**3**
4.	**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.	**10**
5.	**Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.	**12**

Assessment methods

1. Design and experimentation
2. Journal Write-up
3. Open-ended projects and viva-voce

Scheme of Continuous Internal Evaluation (CIE):

Components	Attendance/conduct of lab	Journal	Lab project	Total Marks
Maximum marks :25	10	10	5	25
Submission and certification of journal is compulsory to qualify for SEE Minimum marks required to qualify for SEE: 10 out of 25 marks				

Semester End Examination (SEE):

1.	It will be conducted for 50 marks having 3 hours/2 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted. In case, there are two parts then one experiment from each part.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiment(s), result and conclusion	20 marks	
	One marks question	10 marks	
	Viva-voce	10 marks	
4.	Viva voce is conducted for individual student and not in group		
5.	Minimum passing marks to be scored in SEE: 20 out of 50 marks		

Network Analysis Lab

Course Code	18ECL38	**Credits**	1
Course type	L3	**CIE Marks**	25 marks
Hours/week: L – T – P	0 – 0 – 2	**SEE Marks**	25 marks
Total Hours:	24 hours	**SEE Duration**	3 Hours for 50 marks

Course Learning Objectives (CLOs):

1. To acquaint the students with all the equipments necessary to conduct the experiments during the entire lab course.
2. To provide the students with hands-on experience in the design, analysis, testing, and comprehension of electronic circuits comprising of resistors, capacitors, inductors, power supplies.
3. To introduce principles of circuit analysis from practical perspective.
4. For each experiment, identify the significance and inter-dependency of the circuit elements.
5. To enable the students to design and verify the circuits for the given voltage and current specifications.

List of experiments:

1. Resistive networks: a) Series & Parallel connection b) Star & Delta connection and conversion. Find the current and voltage in each network components.
2. Practical current and voltage sources in a) Series connection b) Parallel connection. Understand the functioning of sources with different connection.
3. Mesh Analysis for DC circuits
4. Mesh analysis for AC circuits
5. Node analysis for DC and AC circuits
6. Verification of Thevenin's and Norton's theorems with DC source
7. Verification of Maximum Power Transform theorem
8. Verification of Superposition theorem
9. Verification of performance of series RLC Resonant circuit
10. Practically determining Z and Y parameters for a resistive network

Text Books

1. M. E. Van Valkenburg, "Network Analysis", Prentice-Hall, 3rd Edition, ISBN: 9789332550131, 9332550131, 2015.
2. A. Sudhakar and S. P. Shyammohan, "Circuits and Networks, Analysis and Synthesis", Tata McGraw Hill Limited, 2017, 3rd Edition.
3. Mahmood Nahvi, and Joseph A. Edminister, "Schaum's Outlines Series: Electric Circuits", McGraw Hill Limited, 4th Edition, 0-07-142582-9, 2003.
4. William J. Hayt Jr., and J. E. Kemmerly, "Engineering Circuit Analysis", Tata McGraw Hill Limited, 2nd Edition. 5th Edition.

Course Outcomes (COs):

At the end of the course, the student will be able to	Bloom's Level
1. Analyze the usage of passive components in series and parallel along with practical sources	L4
2. Compute currents and voltages in/across any branch in a network using mesh and nodal analysis	L3

3.	Simplify complex networks using various network theorems	L4
4.	Analyze series and parallel resonant circuits	L4
5.	Design cascaded two-port networks	L5

Program Outcome of this course (POs)	**PO No.**
1. **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	2
3. **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.	5
4. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.	9
5. **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.	12

Assessment methods

1. Open-ended questions
2. Lab Assessment
3. Viva voce

Scheme of Continuous Internal Evaluation (CIE):

Components	Attendance/conduct of lab	Journal	Lab project	Total Marks
Maximum marks :25	10	10	5	25
Submission and certification of journal is compulsory to qualify for SEE Minimum marks required to qualify for SEE: 10 out of 25 marks				

Semester End Examination (SEE):

1.	It will be conducted for 50 marks having 3 hours/2 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted. In case, there are two parts then one experiment from each part.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiment(s), result and conclusion	20 marks	
	One marks question	10 marks	
	Viva-voce	10 marks	
4.	Viva voce is conducted for individual student and not in group		
5.	Minimum passing marks to be scored in SEE: 20 out of 50 marks		

Fourth Semester
Partial Differential Equations Sampling Techniques Z transform
(Regular All branches except CS/IS)

Course Code	18MATEC41	**Credits**	4
Course type	BS	**CIE Marks**	50
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives (CLO's):

1. Learn the concept of Interpolation and use appropriately.
2. Understand the concept of Partial Differential Equations.
3. Apply Partial Differential Equations to solve practical problems.
4. Get acquainted with Sampling Distribution and Testing of Hypothesis.
5. Study the concept of Calculus of Variations, Z-Transforms and its applications.

Pre-requisites:

1. Partial Differentiation
2. Basic Probability, Probability Distribution
3. Basic Integration
4. Basic Statistics

Unit – I **10 Hours**

Finite Differences and Interpolation: Forward and Backward differences, Newton's Forward and Backward Interpolation Formulae, Divided Differences, Newton's Divided Difference Formula (without proof). Lagrange's Interpolation Formula. Illustrative examples. Numerical Integration: Newton- Cotes Quadrature formula, Trapezoidal rule, Simpsons $1/3^{rd}$ rule, Simpsons $3/8^{th}$ rule, Weddle's rule. Practical Examples

Unit - II **10 Hours**

Partial Differential Equations: Formation of PDE by elimination of arbitrary Constants and Functions, Solution of non-homogeneous PDE by direct integration, Solution of homogeneous PDE involving derivative with respect to one independent variable only.

Unit - III **10 Hours**

Applications of Partial Differential Equations: Derivation of One-dimensional Heat and Wave equations. Solutions of one-dimensional Heat and Wave equations, Two-dimensional Laplace equation by the method of separation of variables. Numerical solution of one-dimensional Heat and Wave equations, Two-dimensional Laplace equation by finite differences.

Unit - IV **10 Hours**

Sampling distribution and Testing of Hypothesis: Sampling, Sampling distribution, Sampling distribution of means, Level of significance and confidence limits, Tests of significance for small and large samples. 't' and 'chi square' distributions. Practical examples.

Unit - V **10 Hours**

Calculus of Variations: Concept of a Functional, Extremal of a Functional, Euler's equation and equivalents. Standard problems. **Applications**: Geodesics, Hanging chain, Minimal surface of revolution and Brachiostochrone problem.

Z -Transform: Definition, Standard Z transforms, Linearity, Damping rule, Shifting properties, Initial and Final value Theorems-Examples. Inverse Z transforms and Solution of Difference Equations by Z transforms.

Books:

Text Books:

1. B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
2. Erwin Kreyszig –Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition,
3. B. V. Ramana- Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd.

Reference Books:

1. P. N. Wartikar & J. N. Wartikar– Applied Mathematics (Volume I and II) Pune Vidyarthi Griha Prakashan, 7th Edition 1994.
2. Peter V. O' Neil – Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition 2011.
3. Glyn James – Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Use** Finite differences in Interpolation	**[L1]**
2. **Form** and **Solve** Partial differential Equations.	**[L1, L2]**
3. **Develop** Heat, Wave equations	**[L3]**
4. **Apply** Partial Differential Equations to solve practical problems	**[L3]**
5. **Test** the Hypothesis and **Solve** problems related to them**.**	**[L1, L2]**
6. Understand the concept of Functional and **Identify** the extremal of a Functional. Understand the concept of Z transforms and solve the problems related to them.	**[L2]**

Program Outcome of this course (POs)	**PO No.**
1. **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	**[PO1]**
2. **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	**[PO2]**

3. **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. **[PO5]**

Course delivery methods	**Assessment methods**
1. Black Board Teaching	1. Internal Assessment
2. Power Point Presentation	2. Assignment
3. **Scilab/MATLAB/ R-Software/Geogebra**	3. Quiz

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments /MATLAB/Scilab activity	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE: 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Vector Calculus, Laplace Transforms and Probability

(Lateral Entry)

Course Code	18DMATEC41	**Credits**	4
Course type	BS	**CIE Marks**	50 marks
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives

Students should

1. Study the concept of double and triple integrals, vector differentiation.
2. Get acquainted with vector integration and its applications.
3. Be proficient in Laplace transforms and inverse Laplace transforms and solve problems related to them.
4. Learn the concept of interpolation and use appropriately.
5. Study the concept of random variables and its applications.

Pre-requisites:

1. Basic probability, probability distributions
2. Basic statistics
3. Basic differentiation and integration

Unit - I 10 Hours

Vector and Integral Calculus: Double and triple integrals. Scalar and vector point function, gradient, divergence, curl, solenoidal and irrotational vector fields.

Unit - II 10 Hours

Vector Integration: Line integral, surface integral, volume integral, Green's theorem, Stoke's theorem, Guass Divergence theorem (statement only) and problems.

Unit - III 10 Hours

Differential Equations: Linear differential equation, Bernoulli's equation, exact differential equation (without reducible forms)-problems and applications (orthogonal trajectories). Linear differential equation with constant coefficients-solution of second and higher order differential equations, inverse differential operator method and problems.

Unit - IV **10 Hours**

Finite Differences and Interpolation: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided difference, Newton's divided difference formula (without proof). Lagrange's interpolation formula. Illustrative examples.

Numerical Integration: Trapezoidal rule, Simpsons 1/3rd rule, Simpsons 3/8th rule, Weddle's rule. Practical examples.

Unit - V **10 Hours**

Probability: Random variables (RV), discrete and continuous random variables (DRV, CRV). Probability distribution function (PDF) and cumulative distribution function (CDF), expectations (mean), variance. Binomial, Poisson, Exponential and Normal distributions and examples.

Books

Text Books:

1. B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012 and onwards.
2. Erwin Kreyszig – Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006 and onwards.
3. B. V. Ramana – Higher Engineering Mathematics, Tata McGraw-Hill Education Private Limited, Tenth reprint 2010 and onwards.

Reference Books:

1. P. N. Wartikar & J. N. Wartikar – Applied Mathematics (Volume I and II) Pune Vidyarthi Griha Prakashan, 7th Edition 1994 and onwards.
2. Peter V. O' Neil – Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition, 2011 and onwards.
3. Glyn James – Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010 and onwards.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Evaluate** double and triple integration.	**[L1, L2]**
2.	**Explain** the concept of vector differentiation and integration.	**[L3]**
3.	**Classify** differential equations of first and higher order and **apply** them to solve relevant problems**.**	**[L1, L2]**
4.	**Use** finite differences in interpolation**.**	**[L1, L2]**

5. **Understand** the concept of random variables, PDF, CDF and its applications **[L2]**

6. **Use** of probability distribution for practical problems **[L2, L3]**

Program Outcome of this course (POs)

		PO No.
1.	**Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	**[PO1]**
2.	**Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	**[PO2]**
3.	**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.	**[PO5]**

Course delivery methods

1. Black Board Teaching
2. Power Point Presentation
3. **Scilab/MATLAB/ R-Software/Geogebra**

Assessment methods

1. Internal Assessment
2. Assignment
3. Quiz

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments /MATLAB/Scilab activity	Quiz/Seminar/Course Project	Total Marks
Maximum marks:50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE: 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Microcontrollers

Course Code	18EC42	**Credits**	4
Course type	PC1	**CIE Marks**	50
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives (CLOs):

1 To understand need and application of Microcontroller particularly ARM Processors in embedded system design.
2 To study the architecture of ARM Processor and program using assembly language.
3 To understand architecture and features of typical ARM7 LPC2148 Microcontroller.
4 To learn interfacing of real-world input and output devices to LPC2148.
5 To learn embedded communication systems.

Pre-Requisites:

1 Digital Electronics

Unit – I **10 Hours**

Introduction to Microcomputer Architecture: Microcomputer Organization (CPU, Memory, I/O Devices and Clock), Processor architecture (ALU, Register and Control Unit), Bus Architecture, Processor characteristics, Instruction set Architecture, RISC and CISC architectures, Concept of polling and interrupts, Computer Languages (Machine level, Assembly level and High-level language).
ARM Embedded Systems: ARM Design philosophy, Embedded System Hardware, Embedded System Software.
ARM Processor Fundamentals: Registers, Program Status Register, Pipeline, Introduction to Exceptions, Interrupts, and the Vector Table.
Case Studies: Survey of various microcontrollers, their specifications, use cases and applications

Unit – II **10 Hours**

ARM Programming:
Introduction to the ARM assembly programming: Structure of assembly module, Directives, Data processing instructions, Data transfer instructions, Control flow instructions, Writing basic assembly language programs.
Architectural support for high level languages: Abstraction in software design, data types, use of memory, run time environment, Expressions, Conditional statements, Loops, Functions and procedures, Programming examples using embedded C.
Case Studies: Analysis of assembly vs C programming for code optimization for the given application.

Unit – III **10 Hours**

LPC2148 Architectural overview: Introduction, Features, Block Diagram of LPC2148 - ARM7TDMI-S processor, On-chip flash memory system, On-chip Static RAM (SRAM), Memory Mapping, LPC2148 Pin out. Pin connect Block, General Purpose Input Output (GPIO).
Case Studies: Communication of LPC2148 to the external world through GPIO's using sensors, actuators and display devices.

Unit – IV **10 Hours**

LPC2148 Peripherals -I: Phase Locked Loops (PLL), Timers, PWM and Watch Dog Timer. Embedded 'C' Programming examples.

Exception and Interrupts: External Interrupt and Vector Interrupt Controller (VIC). Embedded 'C' Programming examples.

Case Studies: Traffic light monitoring system

Unit –V **10 Hours**

LPC2148 Peripherals -II: Universal Asynchronous Receiver Transmitter (UART), ADC, and DAC. Embedded 'C' Programming examples.

Case Studies: Irrigation monitoring system for processing and controlling

Self-learning topic: Power management in ARM processors.

Text Books

1. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide – Designing and Optimizing System Software", ELSEVIER
2 Steve Furber, "ARM System- on-Chip Architecture" LPE, Second Edition
3 UM10139 LPC214x User manual

Reference Books

1 William Hohl, "ARM Assembly Language fundamentals and Techniques" CRC press, 2009
2 Insider's guide to Philips ARM7 based microcontrollers. hitex.co.uk

E-resources

1 NPTEL course - Embedded System - https://nptel.ac.in/courses/108102045/5, 6 and 7
2 NPTEL course - ARM Based Development - https://nptel.ac.in/courses/117106111

Course Outcome (COs):

At the end of the course, the student will be able to	Bloom's Level
1. Apply the knowledge of computer organization to identify the features and architecture for the development of ARM microprocessor and its type.	L3
2. Develop the assembly/C program for the given problem/application, and compare the code optimization through the case studies.	L4
3. Build a small application to using LPC2148 to paraphrase the functioning and programming of GPIOs	L3
4. Use of on-chip peripherals of LPC2148 and write embedded C program to demonstrate their functionality.	L3
5. Design and Develop an embedded system with available resources (open ended examples/Case Studies)	L5/L6

Program Outcome of this course (POs)	PO No.
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	PO1
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified	PO3

	needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	
4	**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.	PO7
5	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
6	**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	PO10
7	**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	PO12

Course delivery methods

1. Classroom Teaching (Blackboard)
2. Presentation
3. Handouts
4. Active Learning methods (Flipped Classroom, Peer Interaction and Cooperative Learning)

Assessment methods

1. IA test
2. Assignment
3. Quiz
4. Activity/ Mini-project

CIE and SEE Pattern:

Theory courses having 4 – 0 – 0 / 3 – 0 – 0 distribution:

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE: 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Control Systems

Course Code	18EC43	**Credits**	4
Course type	PC2	**CIE Marks**	50 marks
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50 marks
Total Hours	50	**SEE Duration**	3 Hours for 100 marks

Course learning objectives (CLOs):

1. Basic concepts, classification and comparison of various types of control systems and evaluation of transfer functions of electrical and mechanical systems in Laplace domain.
2. Determination of transfer function by block reduction technique and signal flow graph method and inspection of concepts like characteristic equation, pole, zero, and system stability.
3. Natural and step response analysis of first and second order systems in time domain and determination of error coefficients and steady state error for such systems with standard inputs.
4. Estimation of system stability by R-H criterion, Root Locus and Bode plot methods and utilizing the concepts of gain margin and phase margin to test absolute and relative system stability.
5. Construction of state variable models, finding its solution and inspection of concepts like state transition matrix, controllability, observability for better understanding of state variable models.

Pre-requisites:

1. Elements of Electrical Engineering (18ELE13/23)
2. Engineering Mathematics (18MAT11, 18MAT21)

Unit - I **10 Hours**

Introduction to Control Systems: Block diagram, explanation, examples and difference of:

a) open loop and closed loop control system
b) Feedforward and Feedback control systems
c) analog and digital control systems.

Transfer function-based modeling – its properties, advantages and disadvantages, transfer function of basic electrical and mechanical (translational and rotational) systems – differential equation and Laplace transform based treatment.

Case Study:

i) Analog type automobile driving control system (mechanical system modeling)

ii) Digital computer-based control for automatic aircraft landing system.

Self-learning topic: Force-Voltage, Force-Current, Torque-Voltage, & Torque-Current analogy.

Unit - II **10 Hours**

Block Diagram, Signal Flow Graph and Introduction to System Stability: Transfer function determination by block reduction technique.
Mason's Gain formula and signal flow graph (SFG) based transfer function determination.
Characteristic equation, pole zero position determination, system stability from pole position in s-domain.

Case Study: Disk drive read system by block reduction technique and system response

Self-learning topic: Determination of system Impulse response and Step response for transfer functions evaluated by block reduction or signal flow graph methods.

Unit - III **10 Hours**

Time Response and Steady State Error Analysis: Natural and Step responses of 1st order RL and RC systems (derivation is self-learning topic), related time domain specifications for these two 1st order systems, 2nd order RLC circuit step responses (with proof) & related time domain specifications for un-damped, under damped, critical damped and over damped cases, related numerical.
Steady state error, error constants, & related numerical for type 0, 1, 2, and 3 systems.

Case Study:

i) Closed loop system error response with disturbances (English Channel boring machines example)
ii) Derivative and integral error compensation.

Self-learning topic: Mathematical proof for natural and step responses for 1st order RL & RC circuits.

Unit - IV **10 Hours**

System Stability Analysis by Classical Methods: Absolute, asymptotic and relative system stability, Routh – Hurwitz stability criterion and related numerical with the two special cases.
Concept & all constructional steps of Root Locus plot.
Bode plot-based system stability analysis in frequency domain, concept of gain & phase crossover frequency, and gain and phase margin.

Case Study:

i) Controller design using Root Locus technique for LASER manipulator control and related system response
ii) Controller design using frequency domain method for engraving machine control.

Self-learning topic: How system stability gets affected when stable pole/s and stable zero/s are inserted in open loop transfer function-learn with specific mathematical examples.

Unit - V **10 Hours**

State Variable System Modeling: Basic concept of state variable modeling, examples on electrical and mechanical state variable system models, determination of state transition matrix and its properties, state variable solutions for homogeneous and non-homogeneous system.
Concepts of controllability, controllability matrix, & complete system controllability for LTI systems.
Concepts of observability, observability matrix, & Kalman observability analysis.

Case Study: State variable models of:

i) Inverted Pendulum
ii) Cruise Control.

Self-learning topic: Determination of transfer function from state variable matrices & vice versa.

Books

Text Books:

1. I. J. Nagarath & M. Gopal, "Control Systems Engineering," New Age International Publications, 5th Edition, 2005.
2. Katsuhiko Ogata, "Discrete Time Control System," Pearson Education, 4th Edition, 1995.

3. Control Systems, "Principles and Design," M Gopal, McGraw Hill Edu; 2nd Edition.
4. Katsuhiko Ogata, "Modern Control Engineering," Pearson Education Asia/PHI, 4th Edition, 2002.
5. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems," Pearson International Edition, 11th Edition.

Reference Books:

1. Benjamin Kuo, "Automatic Control Systems ", John Wiley India Pvt. Ltd., 7th Edition, 2008.
2. Schaum's Outline Series, "Feedback and Control Systems", McGraw Hill Inc.
3. William J. Hayt Jr., and J. E. Kemmerly, "Engineering Circuit Analysis," Tata McGraw Hill Limited, 5th Edition.

E-resourses (NPTEL/SWAYAM, Any Other)- mention links

1. Cruise Control design with MATLAB
   http://ctms.engin.umich.edu/CTMS/index.php?example=CruiseControl&section=SystemModeling

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. *Classify* different control systems, *develop* transfer function based mechanical & electrical system models and *compare* responses of various control systems	L2, L3, L4
2. *Evaluate* system transfer function and *examine* for system stability by *inspecting* the characteristic equations and poles of the transfer functions	L3, L4, L5
3. *Analyze* natural and step responses of 1st and 2nd order systems and *compare* 2nd order system responses under different damping conditions. Also, *determine* error coefficients and steady state errors for various systems.	L3, L4, L5
4. *Estimate* absolute and relative system stability through classical methods by *utilizing* concepts like gain margin, phase margin etc.	L3, L4, L5
5. *Construct* state variable models for electrical and mechanical systems & *inspect* concepts like controllability and observability for system performance analysis.	L4, L5, L6

Program Outcome of this course (POs)	PO No.
1. **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	**1**
2. **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	**2**
3. **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.	**3**
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 information to provide valid conclusions.	**4**
5. **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and	**5**

modelling to complex engineering activities with an understanding of the limitations.

6. **The Engineer and Society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice. **6**
7. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings. **9**
8. **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change. **12**

Course delivery methods	**Assessment methods**
1. Classroom Teaching (Chalk-Board)	1. IA Tests
2. Power Point Presentations	2. Assignments
3. Industrial Visit	3. Quiz
4. Video Lecture Show in Classroom	

CIE and SEE Pattern:

Theory courses having 4 – 0 – 0 / 3 – 0 – 0 distribution:

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE: 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

DSP and Algorithms

Course Code	18EC44	**Credits**	4
Course type	PC3	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 2 – 0	**SEE Marks**	50 marks
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course learning objectives (CLOs):

This course will expose students:

1. To the frequency domain representation of discrete-time signals using DFT
2. To the concepts of efficient computation of DFT.
3. To the concepts of IIR Filter Design.
4. To the concepts of FIR Filter Design.
5. To efficient implementation of DSP algorithms.

Pre-requisites:

1. Signals and Systems (18EC34).

Unit – I 10 Hours

Discrete Fourier Transforms (DFT):

A Digital Signal-Processing System, Introduction to DFT, Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with Fourier Series, Fourier and z-transforms.

Properties of DFT: Multiplication of two DFTs, Circular convolution, Additional DFT properties.

Use of DFT in linear filtering,

Overlap-save and overlap-add method.

Case Study:

To understand real-time use case of convolution.

Unit – II 10 Hours

Fast Fourier Transform (FFT):

Direct computation of DFT, Need for efficient computation of the DFT (FFT algorithms), Radix-2 FFT algorithm for the computation of DFT and IDFT–decimation-in-time and decimation-in-frequency algorithms. (2-4-8 and 8-4-2 butterfly diagrams)

Case Study:

Obtain DFT of a sequence and understand its usage in real time

Self-learning topics: Composite FFT ($N \neq 2^p$)

Unit – III 10 Hours

IIR filter design: Characteristics of commonly used analog filters - Butterworth and Chebyshev filters, analog to analog frequency transformations, Filter design

Digital IIR Filter design using Bilinear transformation and Approximation of derivatives

Structures for IIR systems: Direct form I and form II systems, cascade, Lattice and parallel structures.

Case Study:

Understand the usage of analog filters.

Unit – IV **10 Hours**

FIR Filter Design:

Linear phase FIR filter, Filter design using windows- Rectangular, Hamming, Bartlet and Kaiser windows, Frequency sampling technique for designing FIR filter.

Case Study:

Stitch all the case studies to develop a system involving A/D →DSP operation →D/A processing structure.

Self-learning topics: Implementation of FIR filter, Structures for FIR systems using numerical computing software tool.

Unit – V **10 Hours**

DSP Algorithms:

Development of efficient algorithm to compute Linear Convolution, Circular Convolution, DFT's and FFT's, from algorithm to implementation on DSP Processor using high level programming language.

Self-Study: TMS320C67XX DSP Processor architecture overview only.

Text Books:

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Pearson education / Prentice Hall, 2007, 4th Edition and onwards.
2. Emmanuel C. Ifeachor and Barrie W. Jervis, "Digital Signal Processing: A Practical Approach", 2nd Edition, Pearson Education, 2002 onwards.

Reference Books:

1. Oppenheim & Schaffer, "Discrete Time Signal Processing", PHI, 2003 and onwards.
2. S. K. Mitra, "Digital Signal Processing", Tata Mc-Graw Hill, 3rd Edition, 2010 and onwards.
3. B. Venkatramani, M. Bhaskar, 'Digital Signal Processors Architecture, Programming and Applications', Tata McGraw-Hill Publishing Company Limited, New Delhi, 2002 and onwards.

E-resources:

1. TMS320C6X Manual (Development Support)
   http://www.ti.com/lit/ug/spru226/spru226.pdf
2. Digital Signal Processing, IIT Madras:
   https://nptel.ac.in/noc/individual_course.php?id=noc19-ee50

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Characterize discrete time signals and their spectrum.	L3
2. Compute the DFT of a 8-point sequence using butterfly diagram	L3
3. Design IIR Analog and Digital filter for given specification.	L6
4. Design FIR filter windows for given specification.	L6
5. Implement or develop C code from the DSP algorithms.	L3

Program Outcome of this course (POs)	PO No.
1. **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	**1**

2.	**Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	**2**
3.	**Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.	**3**
4.	**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.	**5**
5.	**Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.	**12**

Course delivery methods

1. Blackboard and Chalk
2. PPT's
3. Videos
4. Activity

Assessment methods

1. Internal Assessment
2. Quiz
3. Assignments/Activities
4. Interaction

CIE and SEE Pattern:

Theory courses having 4 – 0 – 0 / 3 – 0 – 0 distribution:

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE: 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Communication Theory and Techniques

Course Code	18EC45	**Credits**	4
Course type	PC4	**CIE Marks**	50
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50
Total Hours:	50	**SEE Duration**	3 Hours

Course Learning Objectives (CLOs):

1 To understand the fundamental concepts of random processes.
2 To understand and compare different continuous wave modulation techniques.
3 To analyze low power sideband techniques and their applications.
4 To understand the principles and applications of frequency modulation.
5 To analyze principles, application of sampling theorem and to impart the basic concepts of information theory.

Pre-Requisites

1 Statistical- Numerical – Fourier Techniques (18MAT31)
2 Signals and System (18EC34)

Unit – I **10 Hours**

Random Process: Random variables: Several random variables. Statistical averages: Function of Random variables, moments, Mean, Correlation and Covariance function: Principles of autocorrelation function, Cross – correlation functions. Central limit theorem, Properties of Gaussian process, Introduction to noise.

Unit – II **10 Hours**

Continuous Wave Modulation: Introduction, Amplitude modulation, Generation of AM and Detection of an AM wave, Double side band suppressed carrier modulation (DSBSC): Generation of DSBSC: Ring modulator, Coherent detection of DSBSC, COSTAS Receiver.
Case Study: AM radio receiver.

Unit – III **10 Hours**

Single Side-Band Modulation (SSB): Time-Domain description. Demodulation of SSB signals. Hilbert transform, properties of Hilbert transform, Pre-envelope, Canonical representation of band pass signals Single side band modulation: Frequency domain description
Vestigial Side-Band Modulation (VSB): Time and Frequency domain description, Generation and detection. Frequency translation, Frequency division multiplexing
Case Study: Digital Television.

Unit – IV **10 Hours**

Angle Modulation: Frequency Modulation: Narrow band Frequency modulation, wide band FM, transmission band width of FM waves, generation of FM waves: Indirect FM and direct FM. Demodulation of FM waves, FM stereo multiplexing, Phase-locked loop, FM threshold effect, Pre-emphasis and De-emphasis in FM
Case Study: FM Radio
Self-Learning Topic: Time division Multiplexing.

Unit – V **10 Hours**

Sampling Theory: Low pass sampling, Quadrature sampling, Signal Reconstruction, Signal distortion in sampling, Practical Aspects of Sampling and Signal Recovery, Pulse Amplitude Modulation, Pulse width Modulation and Pulse Position Modulation

Measurement of Information: Average information content (entropy) of symbols in long independent sequences, Information rate, Properties of entropy, Joint Entropy, Introduction to Communication Channels.

Text Books

1. Simon Haykin, "An Introduction to Analog and Digital Communications", Wiley, 2003
2. George Kennedy, Bernard Davis and S. R. M. Prasanna, "Electronics Communication Systems",5th edition, McGraw Hill Education (India) Pvt. Ltd.

Reference Books

1. B. P. Lathi, "Modern digital and analog Communication systems" 3rd Edition, Oxford University press, 2005.
2. John G Proakis, Masoud Salehi, "Communication Systems Engineering", (2/e), Person, 2015.
3. K Sam Shanmugam, "Digital and Analog Communication Systems", Wiley, 1994

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Understand and apply various concepts and transforms for computing parameters of communication systems	L2
2. Analyze performance of different types of continuous wave modulation techniques for a given set of parameters	L2
3. Design efficient technique of sideband modulation	L3
4. Analyze various angle modulation techniques	L3
5. Apply sampling concepts and understand the basic concepts of information theory	L3

Program Outcome of this course (POs)	PO No.
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis**: Identify, formulate**,** review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3. **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.	4
4. **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.	12

Course delivery methods	**Assessment methods**
1. Classroom Teaching (Blackboard)	1. IA test
2. Presentation	2. Assignment

3. Video presentations

3. Quiz
4. Activity

CIE and SEE Pattern:

Theory courses having 4 – 0 – 0 / 3 – 0 – 0 distribution:

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE: 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Microcontroller Lab

Course Code	18ECL46	**Credits**	1
Course type	L1	**CIE Marks**	25 marks
Hours/week: L-T-P	0 – 0 – 2	**SEE Marks**	25 marks
Total Hours:	24	**SEE Duration**	3 Hours for 50 marks

Course learning objectives (CLOs):

1 To acquaint students with the fundamentals of ARM processors.
2 To provide hands on experience to analyze, design and test the programs.
3 For each program specification, identify the significance and inter dependency of the processor elements.
4 To introduce to the ARM LPC2148 microcontroller architecture and its peripherals
5 To enable the students to design applications and verify the expected outcomes as per the given specifications using ARM LPC2148 microcontroller.

Pre-requisites:
Computer Programming (18CCP13/18CCP23)

List of experiments

Interfacing using Embedded C program

1. LED and buzzer interface
2. Stepper Motor and DC Motor Interfacing
3. LCD Interfacing
4. Seven Segment display Interfacing
5. DAC interfacing to generate square, triangular, ramp and sine wave.
6. UART Programming
7. On-chip timer and PWM programming
8. Temperature Sensor Interfacing using ADC
9. LED and switch interfacing using interrupt
10. Interrupt based programming/interfacing

Open ended Problems/Mini projects

1. I2C interface
2. SPI interface
3. Watch dog timer programming
4. Real Time Clock programming

Text Books:

1. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide – Designing and Optimizing System Software", ELSEVIER
2 Steve Furber, "ARM System- on-Chip Architecture" LPE, Second Edition
3 UM10139 LPC214x User manual

Reference Books:

1 William Hohl, "ARM Assembly Language fundamentals and Techniques" CRC press, 2009
2 Insider's guide to Philips ARM7 based microcontrollers. hitex.co.uk

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Experiment with the on-chip peripherals of ARM LPC2148 microcontroller using embedded 'C' programming language.	L3
2. Experiment with the programming of external input/output devices and sensors to ARM LPC2148 microcontroller using embedded 'C' programming language.	L4
3. Design and develop applications of ARM LPC2148 microcontroller.	L6

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	**1**
2.	**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.	**3**
3.	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	**5**
4.	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	**9**
5.	**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.	**10**
6.	**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.	**12**

Assessment methods:

1. Pre/Post lab Quiz
2. Lab assessment

Scheme of Continuous Internal Evaluation (CIE):

Components	Attendance/conduct of lab	Journal	Lab project	Total Marks
Maximum marks :25	10	10	5	25
Submission and certification of journal is compulsory to qualify for SEE Minimum marks required to qualify for SEE: 10 out of 25 marks				

Semester End Examination (SEE):

1.	It will be conducted for 50 marks having 3 hours/2 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted. In case, there are two parts then one experiment from each part.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiment(s), result and conclusion	20 marks	
	One marks question	10 marks	

	Viva-voce	10 marks	
4.	Viva voce is conducted for individual student and not in group		
5.	Minimum passing marks to be scored in SEE: 20 out of 50 marks		

Communication Lab

Course Code	18ECL47	**Credits**	1
Course type	L2	**CIE Marks**	25 marks
Hours/week: L – T – P	0 – 0 – 3	**SEE Marks**	25 marks
Total Hours:	24	**SEE Duration**	3 Hours/ 50 marks

Course Learning Objectives (CLOs)

1. To understand basic concepts of analog modulation.
2. To analyze the spectral characteristics of modulated waves.
3. To understand sampling theorem for band-limited signals.
4. To understand various convolution techniques.
5. To understand the design of various filters.

List of Experiments

Part – A (Hardware)

1. Realization of AM modulator.
2. Realization of Ring modulator to generate DSB SC signal.
3. Realization of Frequency Modulation.
4. Realization of AM/FM Demodulator.
5 Convolution using TMS320C6X Processor

Part – B (Software)

6. Analyse spectral characteristics of AM and FM signals.
7. Demonstrate sampling theorem and compute DFT of a finite sequence.
8. Compute Linear and Circular Convolution of two finite sequences
9. Design an IIR filter for given specifications (Low and High Pass filter)
10. Design an FIR filter for given specifications. (Rectangular and Bartlett filter)
11. Compute the Entropy for a given source

Part - B Experiments to be conducted using numerical computing tool.

Books

1. Simon Haykin, "An Introduction to Analog and Digital Communications", John Wiley, 2nd Edition, 2004 and onwards
2. Proakis and Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson Publications, 4th Edition, 2007 and onwards.
3. George Kennedy, Bernard Davis and S. R. M. Prasanna "Electronics Communication Systems",5th edition, McGraw Hill Education (India) Pvt. Ltd.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Explain various analog modulation and demodulation techniques	L2
2. Analyze the spectral characteristics of modulated waves	L3
3. Explain the sampling theorem for band-limited signals and perform DFT	L2
4. Design IIR and FIR filters and demonstrate.	L4
5. Compute entropy and information rate for given discrete source	L4

Program Outcome of this course (POs)	PO No.
1. **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	2
3. **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.	5
4. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.	9
5. **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.	12

Assessment methods:

1. Open ended questions
2. Course projects
3. Viva/Voce

Scheme of Continuous Internal Evaluation (CIE):

Components	Attendance/conduct of lab	Journal	Lab project	Total Marks
Maximum marks :25	10	10	5	25
Submission and certification of journal is compulsory to qualify for SEE Minimum marks required to qualify for SEE: 10 out of 25 marks				

Semester End Examination (SEE):

1.	It will be conducted for 50 marks having 3 hours/2 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted. In case, there are two parts then one experiment from each part.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiment(s), result and conclusion	20 marks	
	One marks question	10 marks	
	Viva-voce	10 marks	
4.	Viva voce is conducted for individual student and not in group		
5.	Minimum passing marks to be scored in SEE: 20 out of 50 marks		

Control Systems Lab

Course Code	18ECL48	**Credits**	1
Course type	L3	**CIE Marks**	25 marks
Hours/week: L-T-P	0 – 0 – 2	**SEE Marks**	25 marks
Total Hours:	24	**SEE Duration**	3 Hours/2 Hours for 50 marks

Course learning objectives (CLOs):

1. Basic concepts, classification and comparison of various types of control systems and evaluation of transfer functions of electrical and mechanical systems in Laplace domain.
2. Determination of transfer function by block reduction technique and signal flow graph method and inspection of concepts like characteristic equation, pole, zero, and system stability.
3. Natural and step response analysis of first and second order systems in time domain and determination of error coefficients and steady state error for such systems with standard inputs.
4. Estimation of system stability by R-H criterion, Root Locus and Bode plot methods and utilizing the concepts of gain margin and phase margin to test absolute and relative system stability.
5. Construction of state variable models, finding its solution and inspection of concepts like state transition matrix, controllability, observability for better understanding of state variable models.

Pre-requisites:

1. Elements of Electrical Engineering (18ELE13/23)
2. Engineering Mathematics (18MAT11, 18MAT21)

List of experiments [in a numerical computing environment]

1. Introduction to control system functions and toolbox.
2. Mathematical modeling of 2^{nd} order mechanical system and its equivalent FV and FI analogy. Determination of related Impulse and Step responses.
3. Software based generation of standard test signals. Basic operation like delay, advance, fold, time scaling and amplitude scaling etc. on these basic signals.
4. Determination of transfer function from system block diagram. Finding systems responses for various test signals.
5. Natural responses of 1^{st} order RL and RC systems. Step and Ramp responses of RL, RC, and RLC systems. Determination of their time domain specifications.
6. Computation of error coefficients and steady state errors for Type 0, Type I, Type II, and Type III systems with Step, Ramp and Parabolic inputs.
7. System time domain response and stability analysis as per pole positions in ‘s-domain’. Lead, lag and lead-lag systems – their pole positions and time domain responses.
8. Root locus plot for different systems with varying system gain.
9. Bode plot-based determination of system stability for different physical systems. Systems with lead, lag and lead-lag compensation are also to be considered.
10. Inverted pendulum state variable modeling - check step response of model.
11. Cruise control state variable modeling - check step response of model.
12. **Group-wise semester long activity:** - Prepare and submit a report on any one control system observed / utilized in day to day life. Suggest modification in existing system for better utility.

Books

1. I. J. Nagarath & M. Gopal, "Control Systems Engineering," New Age International Publications, 4th Edition, 2005.
2. Katsuhiko Ogata, "Discrete Time Control System," Pearson Education, 2nd Edition, 1995.
3. Control Systems, "Principles and Design," M Gopal, McGraw Hill Edu; 4th Edition.
4. Katsuhiko Ogata, "Modern Control Engineering," Pearson Education Asia/PHI, 4th Edition, 2002.
5. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems," Pearson International Edition, 11th Edition.

Reference Books:

1. Benjamin Kuo, "Automatic Control Systems ", John Wiley India Pvt. Ltd., 8th Edition, 2008.
2. Schaum's Outline Series, "Feedback and Control Systems", McGraw Hill Inc.
3. William J. Hayt Jr., and J. E. Kemmerly, "Engineering Circuit Analysis," Tata McGraw Hill Limited, 2nd Edition. 5th Edition.

E-Recourses

1. Cruise Control design with MATLAB
   http://ctms.engin.umich.edu/CTMS/index.php?example=CruiseControl&section=SystemModeling

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. *Classify* different control systems, *develop* transfer function based mechanical & electrical system models and *compare* responses of various control systems	L2, L3, L4
2. *Evaluate* system transfer function and *examine* for system stability by *inspecting* the characteristic equations and poles of the transfer functions	L3, L4, L5
3. *Analyze* natural and step responses of 1st and 2nd order systems and *compare* 2nd order system responses under different damping conditions. Also, *determine* error coefficients and steady state errors for various systems.	L3, L4, L5
4. *Estimate* absolute and relative system stability through classical methods by *utilizing* concepts like gain margin, phase margin etc.	L3, L4, L5
5. *Construct* state variable models for electrical and mechanical systems & *inspect* concepts like controllability and observability for system performance analysis.	L4, L5, L6

Program Outcome of this course (POs)	PO No.
1. **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	**1**
2. **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	**2**
3. **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.	**3**
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis	**4**

and interpretation of data and synthesis of information to provide valid conclusions.

5. **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. **5**
6. **The Engineer and Society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice. **6**
7. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings. **9**
8. **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change. **12**

Assessment methods:

1. Lab Performance
2. Group Activity – Report on one Control System
3. Open ended questions in viva voce

Scheme of Continuous Internal Evaluation (CIE):

Components	Attendance/conduct of lab	Journal	Lab project	Total Marks
Maximum marks :25	10	10	5	25
Submission and certification of journal is compulsory to qualify for SEE Minimum marks required to qualify for SEE: 10 out of 25 marks				

Semester End Examination (SEE):

1.	It will be conducted for 50 marks having 3 hours/2 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted. In case, there are two parts then one experiment from each part.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiment(s), result and conclusion	20 marks	
	One marks question	10 marks	
	Viva-voce	10 marks	
4.	Viva voce is conducted for individual student and not in group		
5.	Minimum passing marks to be scored in SEE: 20 out of 50 marks		

ENVIRONMENTAL STUDIES (MNC)

Subject Code:	18EC39	Credits:	MNC
Course Type:	HS	CIE Marks:	25 marks
Hours/week: L – T – P	2 – 0 – 0	SEE Marks:	-
Total Hours:	28	SEE Duration:	-

Course learning objectives (CLOs)

1. To understand the scope of Environmental Engineering.
2. Identify the Environmental impact due to Human activities.
3. To understand the concept of Disaster Management.
4. Identify the renewable and non-renewable sources of energy.
5. Identify the various Legal aspects in Environmental Protection.

Pre-requisites: NIL

Unit - I 6 Hours

Definition of Environment, Ecology and Eco-system, Structure and functions of ecosystem, balanced ecosystem, Introduction to Environmental Impact Assessment.
Natural Resources: Material Cycles - Oxygen, Carbon, Nitrogen and Hydrological cycle.
Importance of water quality, Water borne diseases, Water induced diseases, Significance of Fluoride in drinking water.

Unit - II 6 Hours

Energy - Different types of energy, Conventional and Non - Conventional sources – Advantages and Limitations of Wind Mills, Hydro Electric, Fossil fuel, Nuclear, Solar, Biomass and Bio-gas, Geothermal energy.

Unit - III 6 Hours

Disasters - Natural Disasters: Meaning and nature of natural disasters, their types and effects (Floods, drought, cyclone, earthquakes, Tsunami). Man Made Disasters: Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution and marine pollution.

Unit - IV 5 Hours

Disaster Management: International strategy for disaster reduction. Concept of disaster management and national disaster management framework

Unit - V 5 Hours

Environmental Protection: Role of Government, Legal aspects, Initiatives by Non - Governmental Organizations (NGO), Environmental Education, Women Education. E waste and solid waste management rules

Books

Text Books:

1. Benny Joseph, "**Environmental Studies**", Tata McGraw - Hill Publishing Company Limited (2005).
2. Ranjit Daniels R.J. and Jagdish Kirshnaswamy, "**Environmental Studies**", Wiley India Private Ltd., New Delhi (2009).

3. Rajagopalan R. "**Environmental Studies – From Crisis to Cure**", Oxford University Press (2005).
4. Sanjay K. Sharma, "**Environment Engineering and Disaster Management**", USP (2011).

References Books:

1. Raman Sivakumar, "**Principles of Environmental Science and Engineering**", Second Edition, Thomson Learning, Singapore (2005).
2. Meenakshi P., "**Elements of Environmental Science and Engineering**", Prentice Hall of India Private Limited, New Delhi (2006).
3. Prakash S.M., "**Environmental Studies**", Elite Publishers, Mangalore (2007).
4. Erach Bharucha, "**Text Book of Environmental Studies**", for UGC, Universities Press (2005).
5. Tyler Miller Jr. G., "**Environmental Science – Working with the Earth**", Tenth Edition, Thomson Brooks/Cole (2004).

Course Outcomes (COs)

	At the end of the course, the student will be able to	Bloom's Level
1.	**Explain** the importance of the Environment	**L2**
2.	**Evaluate** Environmental disasters caused by human activities	**L5**
3.	**Outline** the water stress problems and energy crisis in present era.	**L2**
4.	**Explain and classify** the Renewable and Non-Renewable sources of energy.	**L2**
5.	**Summarize** the various Legislations related to Environment.	**L2**

Program Outcomes (POs)

1	Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering**.**	**PO 1**
2	Graduates shall continue to upgrade the skills and possess the motivation for continuing education and professional growth	**PO 8**
3	Graduates shall maintain an awareness of contemporary issues and arrive at the environmentally sustainable solutions	**PO 9**
4	Graduates shall be proficient in the core principles of Civil Engineering such as Environmental Engineering, Geotechnical Engineering, Structural Engineering and Water Resources Engineering, and shall be able to apply these principles in Engineering practice.	**PO 10**

Content Delivery/Assessments methods and Scheme of Evaluation:

Course delivery methods	Assessment methods
1. Lecture and Board	1. Assignments and Open Book Assignment
2. NPTEL/ Edusat	2. Quizzes
3. Power Point Presentation	3. Internal Assessment Tests
4. Videos	4. Semester End Examination

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Quiz/Assignment/Activity	Total Marks
Maximum marks: 25	10+10 = 20	05	25
• Writing two IA tests is compulsory. • Minimum marks required: 10 out of 25 marks			

ಬಳಕೆ ಕನ್ನಡ
BaLake Kannada

Course Code	**18ECB49/(Revised)**	**Credits**	01
Course type	HS	**CIE Marks**	25 marks
Hours/week: L-T-P	0-2-0	**SEE Marks**	25
Total Contact Hours:	Lecture = 0 Hrs; Tutorial = 2 Hrs Total = 24 Hrs	**SEE Duration**	2 Hrs for 50 marks

Course Learning Objectives:

The course will enable the students to understand Kannada and communicate (converse) in Kannada language.

Table of Contents

Necessity of learning a local langauge:

The learning of local language,

- Encourages the respect for other people: it fosters an understanding of the interrelation of language and human nature.
- Expands one's view of the world, liberalizes one's experiences, and makes one more flexible and tolerant.
- Limits the barriers between people: barriers cause distrust and fear.
- Opens the door to art, music, dance, fashion, cuisine, film, philosophy, science…etc.
- Leads to an appreciation of cultural diversity.
- Helps fluent communication.

Language learning helps to develop strong cognitive skills, such as a better concept formation, mental flexibility, multitasking, listening skills and problem-solving, in addition to improve social interaction and also encourages the connection between peers.

Use of local language help to mingle with the local society and ensures security, pleasant welcoming from auto/cab drivers, shop owners, employees of local government etc., and make the living easier and more comfortable.

Tips to learn the language with easy methods.

Apart from the conventional method of learning from teachers, the learning of language can be accelerated by adopting the following methods.

1) Love the learning without boredom.

2) Talk to classmates and others in Kannada without hesitation and with no concern to grammatical mistakes during the initial stages of learning the language.

3) Use English words to continue the conversation when you find difficulty in finding suitable Kannada word/s. Vocabulary improves with the use of language.

4) While reading, read aloud (not silently or in a whisper manner, but audibly so that others are not being disturbed or others can hear what is being read). Reading aloud not only helps proper/ correct pronunciation of words with variation in pitch, pace, volume, pauses etc., but also produces a fluent and enjoyable delivery during conversation/debate/presentation.

5) Listen to Kannada news and watch Kannada movies.

6) Listen to Kannada FM radios for news, live conversations and songs.

7) Use online applications (apps) for fast learning.

Easy learning of a Kannada Language: A few tips

1. Watching Kannada movies (preferably with subtitles), can be of great help. This is an important and entertaining way to improve your language skills.
2. Do not hesitate. Speak the language at every possible opportunity.
3. Never mind if you are using less Kannada and more English words. Kanglish is anyway popular in Bangalore. However constantly try to improve your Kannada vocabulary.
4. Watch Kannada news. This is not only helpful in learning the language, but will help you to know your city better.
5. If you are a user of public transport, carefully listen to co-passengers' conversations.
6. Enjoy the local tang of the language by listening to Kannada FM stations.
7. Do not completely rely on 'Learn Kannada in 30 days' type of books. Many Bangaloreans will fail to comprehend your textbook language and you are sure to face some embarrassment, if you go strictly by books.

Hints for correct and polite conservation

1) Be vigilant about the verbs, the pronouns, the genders and tense required for day to day Conversation.

2) Pronounce the words properly.

3) Use plural form to address others.

4) Use simple sentences for conversation.

About Kannada Language (Kannada Bhashe)

- Kannada is one of the classical (Shastreeya) languages of India since November 01, 2008, and is the official language of the Karnataka state.
- This language is not just confined within the borders of Karnataka, for you will find it spoken by people in parts of the neighboring states of Andhra Pradesh, Tamil Nadu and Maharashtra. Kannada is spoken in its various dialects by Six to Seven million people across the globe. It is one among the top 40 most spoken languages of the world.
- Spoken Kannada is in use since 2500 years, and has its own script since 1900 years. Spoken Kannada varies according to the regions of Karnataka, while the written form of

Kannada remains almost the same. Kannada is the third oldest language of India (after Sanskrit and Tamil).

The written form of Kannada is phonetic and it is written as it is spoken.

The first Kannada-English Dictionary (ShabdaKosha) was compiled in 1894 by a German priest, Rev. Ferdinand Kittel. He also wrote a book on Kannada Grammar entitled, "A Grammar of the Kannada Language: Comprising the Three Dialects of the Language".

- Several noted centuries old literary works of Kannada have been translated into Sanskrit, and other languages.
- November 1st of every year is celebrated as Kannada Rajyotsava Day throughout Karnataka state and is declared as a state holiday. This was the day that the name Karnataka was given to the Mysore state in the year 1973.

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1.	Spell and Translate in Kannada language	L1,L2

Program Outcome of this course (POs)		PO No.
1.	Communicate effectively with society at large	**10**

Course delivery methods

1. Lectures
2. Presentation
3. Videos

Assessment methods

1. IA tests
2. Presentation
3.

Scheme of Continuous Internal Evaluation (CIE):

Components	Two IA Tests	Assignment/Quiz/Presentation/activity	Total marks
Maximum Marks: 25	10 + 10	5	25
•Writing two IA tests is compulsory. • Minimum marks required to qualify for SEE:: 10 out of 25 marks			

Semester End Examination (SEE):

1. It will be conducted for 2 hours duration and 50 marks. It will be reduced to 25 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 20 out of 50 marks
3. Question paper will have objective and one line questions for each lesson.

3rd/ 4th sem B.E.
(for **Kannadigas,** Common to B.Arch and B.E. all branches**)**

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

Course Code	**18ECS49**	**Credits**	01
Course type	HS	**CIE Marks**	25 marks
Hours/week: L-T-P	0-2-0	**SEE Marks**	25
Total Contact Hours:	Lecture = 0 Hrs; Tutorial = 2 Hrs Total = 24 Hrs	**SEE Duration**	2 Hrs for 50 marks

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

- ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡದ ಜೊತೆಗೆ ಕ್ರಿಯಾತ್ಮಕ ಕನ್ನಡವನ್ನು, ಕನ್ನಡ ಸಾಹಿತ್ಯ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ನಾಡು ನುಡಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು ಮತ್ತು ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ಬರೆಹದಲ್ಲಿ ಕಂಡುಬರುವ ದೋಷಗಳು ಹಾಗೂ ಅವುಗಳ ನಿವಾರಣೆ.
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಆಸಕ್ತಿ ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯಪುಸ್ತಕ

ಪರಿವಿಡಿ

ಭಾಗ – ಒಂದು ಲೇಖನಗಳು

ಕನ್ನಡ ನಾಡು, ನುಡಿ ಮತ್ತು ಸಂಸ್ಕೃತಿಗೆ ಸಂಬಂಧಿಸಿದ ಲೇಖನಗಳು

೧. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ : ಹಂಪ ನಾಗರಾಜಯ್ಯ

೨. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ : ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ – ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ

೩. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ – ವಿತಾವಿಯ ಆಡಳಿತ ಕನ್ನಡ ಪುಸ್ತಕದಿಂದ ಆಯ್ದ ಲೇಖನ*

ಭಾಗ – ಎರಡು

ಕಾವ್ಯ ಭಾಗ (ಆಧುನಿಕ ಪೂರ್ವ)

೪. ವಚನಗಳು : ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರ ದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ.

೫. ಕೀರ್ತನೆಗಳು : ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ – ಪುರಂದರದಾಸ
ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೆ – ಕನಕದಾಸ

೬. ತತ್ವಪದಗಳು : ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು – ಶಿಶುನಾಳ ಷರೀಫ
ಶಿವಯೋಗಿ – ಬಾಲಲೀಲಾ ಮಹಾಂತ ಶಿವಯೋಗಿ

೭. ಜನಪದ ಗೀತೆ : ಬೀಸುವ ಪದ, ಬಡವರಿಗೆ ಸಾವ ಕೊಡಬೇಡ

ಭಾಗ – ಮೂರು

ಕಾವ್ಯ ಭಾಗ (ಆಧುನಿಕ)

೮. ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗ : ಡಿ.ವಿ.ಜಿ.

೯. ಕುರುಡು ಕಾಂಚಾಣ : ದ.ರಾ. ಬೇಂದ್ರೆ

೧೦. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು

೧೧. ಹೆಂಡತಿಯ ಕಾಗದ : ಕೆ.ಎಸ್. ನರಸಿಂಹಸ್ವಾಮಿ

೧೨. ಮಬ್ಬಿನಿಂದ ಮಬ್ಬಿಗೆ : ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ

೧೩. ಆ ಮರ ಈ ಮರ : ಚಂದ್ರಶೇಖರ ಕಂಬಾರ

೧೪. ಚೋಮನ ಮಕ್ಕಳ ಹಾಡು : ಸಿದ್ಧಲಿಂಗಯ್ಯ

ಭಾಗ – ನಾಲ್ಕು

ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿ ಪರಿಚಯ, ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ

೧೫. ಡಾ. ಸರ್ ಎಂ ವಿಶ್ವೇಶ್ವರಯ್ಯ – ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ : ಎ ಎನ್ ಮೂರ್ತಿರಾವ್

೧೬. ಯುಗಾದಿ : ವಸುಧೇಂದ್ರ

೧೭. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ : ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ

ಭಾಗ – ಐದು

ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ

೧೮. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ : ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ

೧೯. 'ಕ' ಮತ್ತು 'ಬ' ಬರಹ ತಂತ್ರಾಂಶಗಳು ಮತ್ತು ಕನ್ನಡದ ಟೈಪಿಂಗ್*

೨೦. ಕನ್ನಡ – ಕಂಪ್ಯೂಟರ್ ಶಬ್ದಕೋಶ*

೨೧. ತಾಂತ್ರಿಕ ಪದಕೋಶ : ತಾಂತ್ರಿಕ ಹಾಗೂ ಪಾರಿಭಾಷಿಕ ಕನ್ನಡ ಪದಗಳು*

* (ವಿತಾವಿಯ ಆಡಳಿತ ಕನ್ನಡ ಪುಸ್ತಕದಿಂದ ಆಯ್ದ ಲೇಖನಗಳು – ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ.. ವಿ. ಕೇಶವಮೂರ್ತಿ)

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1.	Explain, interpret, summarize and Translate in Kannada language for administrative purposes	L1,L2

Program Outcome of this course (POs)		PO No.
1.	Communicate effectively with society at large	10

Course delivery methods

1. Lectures
2. Presentation
3. Videos

Assessment methods

1. IA tests
2. Presentation
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3. Question paper will have objective and one-line questions for each lesson.