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: Electrical & Electronics Engineering

Programme: B.E.

3rd & 4th 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 calibre, 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 mind-set.

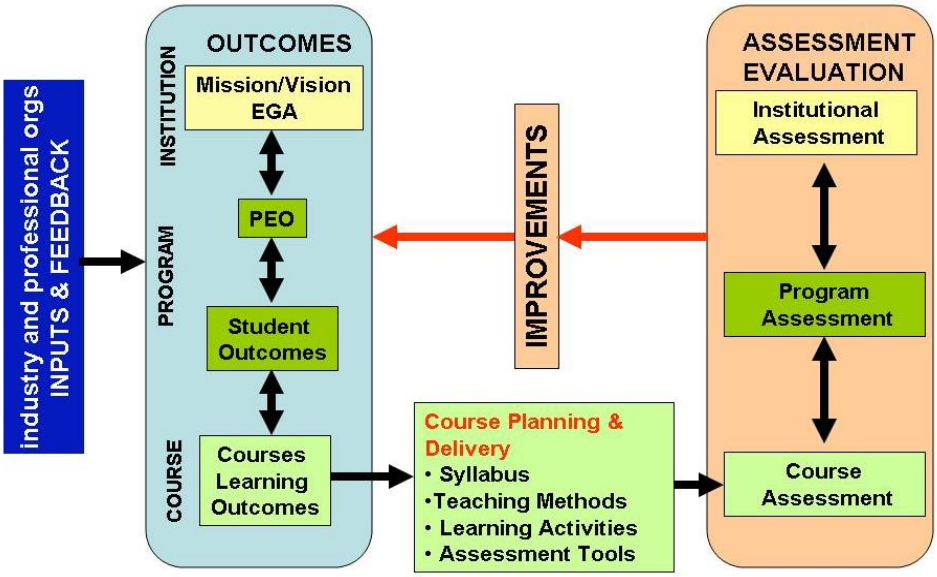
QUALITY POLICY

- 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
Department of Electrical and Electronics Engineering focuses on Training Individual aspirants for Excellent Technical aptitude, performance with outstanding executive calibre and industrial compatibility.

MISSION
To impart optimally good quality education in academics and real time work domain to the students to acquire proficiency in the field of Electrical and Electronics Engineering and to develop individuals with a blend of managerial skills, positive attitude, discipline, adequate industrial compatibility and noble human values.

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. Apply the concepts of Electrical and Electronics Engineering necessary to attend engineering problems in multidisciplinary domain with a blend of social and environmental aspects with technical and professional competence

2. Participate in the activities that lead to professional and personal growth with self-confidence to adapt to ongoing changes in technology and career development.

3. Develop managerial and entrepreneurship skills embedded with human and ethical values.

PROGRAM SPECIFIC OUTCOMES (PSOs):

1.To demonstrate an understanding of the basic concepts Electrical and Electronics technology with an adequate knowledge of mathematics and science during problem analysis, formulation of solutions, design and development activities.

2. To demonstrate an understanding of the concepts of the core Electrical Engineering aspects such as Electrical machines and Power systems during real time analysis, design and operation.

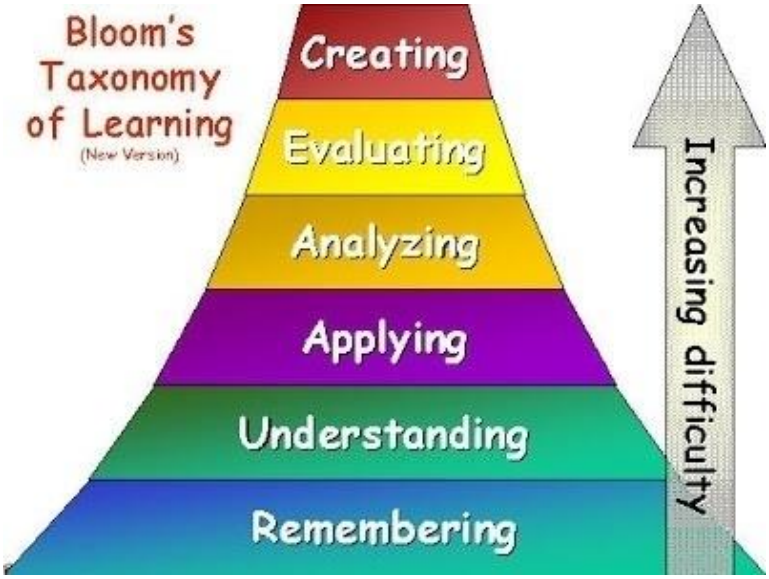
3.To demonstrate an understanding of the concepts of Electronics technology in the form of Analog and Digital Electronics, Microprocessors and embedded systems required in data acquisition, data processing, automation and control applications and demonstrate capability to comprehend the technological advancements and usage of modern tools keeping up lifelong learning attitude.

4. To demonstrate good managerial and entrepreneurship skills embedded with good communication skill, team work attitude professional ethics and the concern for societal and environmental goodness.

BLOOM'STAXONOMYOFLEARNINGOBJECTIVES

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 21stcentury. 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:

Compulsory Foundation: 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)**.

Foundation Electives: These are value based courses aimed at man making education. The course is related to **Humanities and Social Science Courses (HS).**

(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.

An elective may be **Discipline Centric(PE)** or **Open Elective(OE).**

(iv) Mandatory Non-Credit Courses (MNC): These courses are mandatory for students joining B.E 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
Practical (P): Two hours /week – 1 credit;

Scheme of Teaching and Examination- 3rd & 4th Semester B.E.

Scheme of Teaching

Third Semester (Regular)									
S.No	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T - P			**CIE**	**SEE**	**Total**
1	18MATEE31	Statistical-Numerical – Fourier Techniques	BS	4 – 0 – 0	4	4	50	50	100
2	18EE32	DC machines & Transformers	PC	4 – 0 - 0	4	4	50	50	100
3	18EE33	Network Analysis	PC	3 –2 – 0	5	4	50	50	100
4	18EE34	Analog Electronic Circuits	PC	3 – 2 – 0	5	4	50	50	100
5	18EE35	Logic Design	PC	3 – 2 – 0	5	4	50	50	100
6	18EEL36	Analog Electronics Lab	PC	0 – 0 – 2	2	1	25	25	50
7	18EEL37	Logic Design Lab	PC	0 – 0 –2	2	1	25	25	50
8	18EEL38	Electrical Measurements and Circuit Simulation Lab	PC	0 – 0 – 2	2	1	25	25	50
9	18EE39	Kannada	HS	2 – 0 - 0	2	1	25	25	50
		Total			**31**	**24**	**350**	**350**	**700**

Third Semester (Diploma)									
S.No	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T - P			**CIE**	**SEE**	**Total**
1.	18DMATEE31	Calculus, Fourier Analysis & Linear Algebra	BS	4 – 0 – 0	4	4	50	50	100
2	18EE32	DC Machines and Transformers	PC	4 – 0 – 0	4	4	50	50	100
3	18EE33	Network Analysis	PC	3 –2–0	5	4	50	50	100
4	18EE34	Analog Electronic Circuits	PC	3 – 2 – 0	5	4	50	50	100
5	18EE35	Logic Design	PC	3 – 2 - 0	5	4	50	50	100
6	18EEL36	Analog Electronics Lab	PC	0 – 0 – 2	2	1	25	25	50
7	18EEL37	Logic Design Lab	PC	0 – 0 – 2	2	1	25	25	50
8	18EEL38	Electrical Measurements and Circuit Simulation Lab	PC	0 – 0 – 2	2	1	25	25	50
9	18EE39	Kannada	HS	2– 0 – 0	2	1	25	25	50
		Total			**31**	**24**	**350**	**350**	**700**

Fourth Semester (Regular)									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T - P			**CIE**	**SEE**	**Total**
1.	18MATEE41	Partial Differential Equations, Sampling Techniques, Z transform	BS	4 – 0 – 0	4	4	50	50	100
2	18EE42	Electrical Power Generation Transmission and Distribution	PC	4– 0 - 0	4	4	50	50	100
3	18EE43	Synchronous & Induction Machines	PC	4 –0 - 0	4	4	50	50	100
4	18EE44	Control Systems	PC	3– 2 - 0	5	4	50	50	100
5	18EE45	Signals, Systems and Processing	PC	3 –2 - 0	5	4	50	50	100
6	18EEL46	Linear IC's & Applications Lab	PC	0 – 0 – 3	3	1.5	25	25	50
7	18EEL47	Electrical Machines Lab	PC	0 – 0 – 3	3	1.5	25	25	50
8	18EEL48	Signals, systems and Processing Lab	PC	0 – 0 – 2	2	1	25	25	50
9	18EE49	Environmental Studies	HS	2 – 0 - 0	2	MNC	25	-	25
		Total			**33**	**24**	**350**	**325**	**675**

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

Fourth Semester (Diploma)									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T - P			**CIE**	**SEE**	**Total**
1	18DMATEE41	Vector Calculus, Laplace Transforms & Probability	BS	4 – 0 – 0	4	4	50	50	100
2	18EE42	Electrical Power Generation Transmission and Distribution	PC	4– 0 - 0	4	4	50	50	100
3	18EE43	Synchronous & Induction Machines	PC	4 –0 - 0	4	4	50	50	100
4	18EE44	Control Systems	PC	3– 2 - 0	5	4	50	50	100
5	18EE45	Signals System and Processing	PC	3 –2- 0	5	4	50	50	100
6	18EEL46	Linear IC's & Applications lab	PC	0 – 0 – 3	3	1.5	25	25	50
7	18EEL47	Electrical Machines Lab	PC	0 – 0- 3	3	1.5	25	25	50
8	18EEL48	Signals, Systems & Processing Lab	PC	0 – 0 – 2	2	1	25	25	50
9	18EE49	Environmental Studies	HS	2 – 0 - 0	2	MNC	25	-	25
		Total			**33**	**24**	**350**	**325**	**675**

Statistical – Numerical – Fourier Techniques
(Common to all branches)

Course Code	18MATEE31	**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

To impart an ability to the students to

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.

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.	
6. **Apply** Joint Probability Distribution, Stochastic processes to solve relevant problems.	L3

Program Outcome of this course (POs)	**PO No.**
Students will acquire	
1. An ability to apply knowledge of mathematics, science and engineering.	PO1
2. Identify, formulate, research literature and analyze complex engineering problems, reaching substantiated conclusions using first principles of mathematics, natural Sciences and Engineering. Sciences	PO2
3. 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. Scilab	2. Assignment
	3. Quiz/Seminar/Course Project

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 test is compulsory.
- **Minimum marks required to qualify for SEE: 20 out of 50**

Scheme of Semester End Examination (SEE):

It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.

Minimum marks required in SEE to pass: 40 out of 100 marks

Question paper contains10 questions each carrying 20 marks. Students have to answer FIVE full questions selecting at least one from each unit.

Semester III

Calculus, Fourier Analysis and Linear Algebra

(For Diploma All Branches)

Course Code	18DMATEE31	**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

To impart an ability to the students to

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.

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 usingFourier 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.
Students will acquire		
1.	An ability to apply knowledge of mathematics, science and engineering.	PO1
2.	Identify, formulate, research literature and analyze complex engineering problems, reaching substantiated conclusions using first principles of mathematics, natural Sciences and Engineering. Sciences	PO2
3.	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 Tests
2. Power point presentation	2. Assignments
3. Scilab/ Matlab/ R-Software	3. Quiz/Seminar/Course Project

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 test is compulsory.
- **Minimum marks required to qualify for CIE: Minimum 20 out of 50 marks**

Scheme of Semester End Examination (SEE):

1. Question paper contains 10 questions each carrying 20 marks. Students have to answer FIVE full questions.
2. **Minimum marks required in SEE to pass: 40 out of 100 marks.**
3. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.

D.C. MACHINES AND TRANSFORMERS

Course Code	18EE32	**Credits**	4
Course type	PC	**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

To impart an ability to the students to

1. Understand and analyze equivalent circuit models, performance calculations of various types of transformers and parallel operation.
2. Analyze the parallel operation and load sharing of single phase transformer and explain the three phase transformer connections.
3. Explain principle of operation, construction, working, operating characteristics and performance calculations for DC machines.
4. Explain and demonstrate speed control techniques of dc motors and various methods of testing of DC machines and determine losses and efficiency.
5. Describe construction and applications of special machines.

Pre-requisites: Basic electrical engineering.

Unit - I 10 Hours

a. Single phase Transformers: EMF equation (excluding derivation), concept of ideal transformer, operation of practical transformer on no load and load (R, L, C loads with phasor diagrams), types of transformers based on applications (brief discussion), illustrative problems.

3 Hours

b. Performance analysis of single phase Transformers: Transformer circuit parameters, equivalent circuit, losses, efficiency, condition for maximum efficiency, all day efficiency. Open circuit and short circuit tests, calculation of parameters of equivalent circuit. Voltage regulation, predetermination of efficiency, Sumpner's test, illustrative problems.

5 Hours

c. Single phase Auto-transformers-Introduction, saving in conductor material. Advantages and disadvantages, applications of auto-transformer, illustrative problems.

2 Hours

Self learning topics: Operation of practical transformer for RC-load, Sumpner's test.

Unit - II 10 Hours

a. Parallel operation of transformers - Polarity of transformers, polarity test, parallel operation of single phase transformers, necessity and desirable conditions for parallel operation, Load sharing in case of similar and dissimilar transformers (excluding derivations), illustrative problems.

4 Hours

b. Three-phase Transformers: Single unit three-phase transformer and bank of three single-phase transformers. Three phase transformer connections– star/star, delta/delta, star/delta, delta/star, open delta, Scott connection. Applications and factors affecting choice of

connections. Conditions for parallel operation of three-phase transformers, load sharing. Equivalent circuit of three-phase transformer, conservator and breather

6 Hours

Self learning topics: Factors affecting choice of connections, conservator and breather.

Unit - III **10 Hours**

a. DC Generators- Principle of operation of DC generator, construction of DC machine, classification of DC generator, types of armature windings, EMF equation (excluding derivation), armature reaction, Commutation, types of commutation, methods of improving commutation (interlopes, compensating winding), applications of DC generators, illustrative problems.

4 Hours

b. DC Motors- Principle of operation of DC motor, classification of DC motors, back EMF and its significance, torque equation (excluding derivation), characteristics of shunt &series motors, Applications of DC motors, starting of DC motors, three pointstarter, illustrative problems.

4 Hours

c. Speed control of DC motors: Methods of speed control of shunt, series DC motors, illustrative problems.

2 Hours

Self learning topics: characteristics ofseries motors, three point starter

Unit - IV **10 Hours**

a. Losses and efficiency: Losses in DC machines, power flow diagram, efficiency, condition for maximum efficiency (excluding derivation), illustrative problems.

5 Hours

b. Testing of dc machines: Direct & indirect methods of testing of DC machines- Swinburne's test, Hopkinson's test, Field's test, merits and demerits of tests, illustrative problems.

5 Hours

Unit - V **10 Hours**

a. Special Electrical Machines-I: DC servomotors, brushless DC motors, permanent magnet DC motors, stepper motor (VR type only)

3 Hours

b. Special Electrical Machines-II: Construction and applications of welding transformer, tap changing transformer, tap changing transformer, booster transformer, instrument transformers.

7 Hours

Self learning topics: PMDC motors, instrument transformers

Text Books

1. V. K. Mehta &Rohit Mehta, **"Electrical Machines"**, S. Chand & Co. Ltd. Publications, second edition, 2012.
2. Ashfaq Hussain, **"Electrical Machines"**, Dhanpat Rai & Co. Publications, third edition, 2015.

Reference Books

1. I. J. Nagrath and D. P. Kothari, **"Electrical Machines"**, TMH, 4th Edition, 2010.
2. A. E. Fitzgerald, Charles Kingsley Jr., S. D. Umans, **"Electrical Machines"**, TMH, 6th edition. 2006.
3. P.S Bhimbra, Khanna Publishers, **"Electrical Machines"**, 2nd edition, 2001

E-Resources: https://nptel.ac.in/course.php

Course Outcome (COs)

At the end of the course, students will be able to	**Bloom's Level**
1. **Analyze** equivalent circuit model of transformer, performance calculations of various types of transformers and **explain** parallel operation.	L2, L3,L4
2. **Analyze** the parallel operation and determination of load sharing of single phase transformer and **explain** the three phase transformer connections.	L2, L3, L4
3. **Explain** the principle of operation, construction, working, operating characteristics and performance **calculations** for DC machines.	L2, L5
4. **Identify** and **explain** speed control techniques of dc motors and the methods of testing of DC machines and predetermination of efficiency.	L2, L3
5. **Explain** construction and applications of special machines.	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. **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.	PO3
4. Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.	PO4
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.	PO12

Course delivery methods

1. Black Board teaching
2. Power Point Presentations
3. Animations/videos
4. Field visits

Assessment methods

1. Internal Assessment Tests
2. Quiz/Seminar/Course Project
3. Assignments
4. Semester End Examination

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	18EE33	**Credits**	4
Course type	PC	**CIE Marks**	50
Hours/week: L-T-P	3-2-0	**SEE Marks**	50
Total Hours:	50	**SEE Duration**	3 hours for 100 marks

Course learning objectives:

To impart an ability in students to

1. Understand and explain the basic concepts and types of electrical networks, basic tools of network analysis.
2. Explain and apply useful tools like network theorems and their applications in network analysis.
3. Understand and explain the concept and analysis of series and parallel resonant circuits and the practical applications. Concept of graph theory for the real time problems.
4. Describe the concept of switching, behaviour of electric network parameters during switching, transient and steady state response of typical electric networks using Laplace transformation tools.
5. Study and analyze two port network models.

Pre-requisites: Basic Electrical Engineering, mathematical concepts of calculus, Laplace transformation

UNIT-I 10 Hours

Basic Concepts: Practical sources, source transformations, network reduction using Star – Delta transformation, loop and node analysis for linear DC and AC networks with dependent and independent sources, concepts of super node and super mesh.

UNIT-II 10 Hours

Network Theorems – Superposition, Reciprocity, Millman's, Thevenin's, Norton's and Maximum power transfer theorems and numerical**.**

UNIT-III 10 Hours

Resonant Circuits: Series resonance and parallel resonance, frequency- response of series and parallel circuits, Q –factor, bandwidth. **5 hours**

Network Topology: Graph of a network, concept of tree and co-tree, incidence matrix, tie-set and cut-set schedules, formulation of equilibrium equations in matrix form, solution of resistive networks, principle of duality**.** **5 hours**

Self-Learning Topics: Resonant circuits.

UNIT-IV 10 Hours

Transient Behavior and Initial Conditions: Behavior of circuit elements under switching condition and their representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations. **5 hours**

Laplace Transformation & Applications: Solution of networks, step, ramp and impulse responses, waveform synthesis. **5 hours**

UNIT-V 10 hours

Two Port Network Parameters: Definition of Z, Y, H and transmission (ABCD) parameters, modeling with these parameters, relationship between parameters.

Text Books

1. M. E. Van Valkenburg, **"Network Analysis",** PHI / Pearson Education, 3rd edition.
2. Roy Choudhury, **"Networks and systems",** 2nd edition, New Age International Publications.

Reference Books

1. A.Chakrabarti, "**Circuit Theory Analysis and Synthesis",** Dhanpat Rai & Co.
2. Hayt, Kemmerly and Durbin, **"Engineering Circuit Analysis",** TMH 7th edition.

E-Resources: https://nptel.ac.in/course.php

Course Outcome (COs)

At the end of the course, students will be able to	**Bloom's Level**
1. **Apply** the basic concepts and basic tools of network analysis.	L3
2. **Apply** useful tools like network theorems for various **applications** of network **analysis** in Electric networks**.**	L3, L4
3. **Design** and **analyze** series and parallel resonant circuits and apply for the practical applications.	L4, L5
4. **Apply** concept of graph theory for real time problems**.**	L3
5. **Understand** and **analyze** transient and steady state response of typical electric networks for different types of input signals using Laplace transformation tools**.**	L2,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.	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. **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. Chalk Board
2. Power Point Presentations

Assessment methods

1. Internal Assessment Tests
2. Quiz/Seminar/Course Project
3. Assignments
4. Semester End Examination

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 ELECTRONIC CIRCUITS

Course Code	18EE34	**Credits**	4
Course type	PC	**CIE Marks**	50
Hours/week: L-T-P	3-2-0	**SEE Marks**	50
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

To impart an ability to the students to

1. Understand operation and applications of basic solid state devices namely diodes and transistors.
2. Analyse Bipolar Junction Transistor by modelling.
3. explain various types of BJT amplifiers, their operating characteristics, frequency response and analyse their performance parameters.
4. Analyse and explain operation and characteristics of different types of Oscillators.
5. Understand operation and characteristics of special purpose solid state devices namely optoelectric diodes, Varactor, Tunnel Diode.
6. Understand basic operation and characteristics of Field effect transistors namely DMOS, EMOS and basics of CMOS Technology.

Pre-requisites : Basic Electronics

Unit - I 10 Hours

Diode Circuits: Diode equivalent circuits, clippers and clampers using diodes, half wave and full wave rectifier, and Voltage regulator basics.

Unit - II 10 Hours

Transistor Biasing (BJT): Operating point, Common Emitter Configuration, Fixed bias circuits, Emitter biased circuits, Voltage divider biased and Collector feedback circuit, transistor as a switch, Bias stabilization definition.

Unit - III 10 Hours

BJT transistor modelling: 'r_e' Model of BJT, r_e Model for CE Fixed bias configuration, Voltage divider bias and Emitter follower Circuit; h- parameter model for BJT.

R-C Coupled Amplifier Frequency Response: low frequency response, High frequency response (Miller effect capacitance).

Unit - IV 10 Hours

Feedback Systems: Feedback concept, transfer gain with feedback, Feedback connections types, General Characteristics of negative feedback in amplifiers, Input resistance, Output resistance, Advantages of negative feedback in amplifiers

Oscillators: Positive Feedback, RC Phase shift Oscillator, Wien-bridge Oscillator using BJT.

Power Amplifiers: Types of Power amplifiers, series fed class A amplifier, Transformer coupled Class A amplifiers, Class B amplifier circuits and operations, cross over distortions

Self learning topics: Advantages of negative feedback in amplifiers

Unit - V **10 Hours**

Special purpose diodes: Optoelectronic devices, Varactor, Tunnel diode.
Field Effect Transistors: Junction Field Effect transistor (JFET), JFET volt-amp characteristics, D-MOSFET, EMOSFET characteristics, and CMOS technology basics.

Self learning topics: D-MOSFET, EMOSFET characteristics,

Text Books

1. Robert L. Boylestad and Louis Nashelsky"Electronic Devices and Circuit Theory", PHI 9th Edition 2011
2. David A. Bell, "Electronic Devices and Circuits", PHI, 4th Edition, 2004

Reference Books/Papers

1. Jacob Millman& Christos C. Halkias, 'Integrated Electronics', Tata -McGraw Hill, 2nd Edition, 2010
2. Albert Malvino& David J Bates, "Electronic Principles", 7th Edition, TMH, 2007

E-Sources

https://onlinecourses-archive.nptel.ac.in/noc18_ee45

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Explain** the operation and applications of basic solid state devices namely Diodes and transistors. Analyse/ Design diode and BJT circuits.	L1, L2, L3, L4
2. **Explain/Analyse** BJT Models and frequency response details of BJT amplifiers.	L1, L2, L3, L4
3. **Explain** and **analyse** various types of BJT Power amplifiers and oscillators, their operating characteristics and performance analysis.	L1, L2, L3, L4
4. **Explain** characteristics and applications of special purpose solid state devices namely optoelectric diodes, Varactor, Tunnel diode.	L1,L2
5. **Explain** operation and characteristics of Field effect transistors, DMOS, EMOS and explain about CMOS Technology.	L1, 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	**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. Chalk Board
2. Power Point Presentations

Assessment methods

1. Internal Assessment Tests
2. Quiz/Seminar/Course Project
3. Assignments
4. Semester End Examination

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 atleast one full question from each unit.

LOGIC DESIGN

Course Code	18EE35	**Credits**	4
Course type	PC	**CIE Marks**	50
Hours/week: L-T-P	3-2-0	**SEE Marks**	50
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

To impart an ability to the students to

1. Demonstrate an understanding of the principles of combinational logic with knowledge of Boolean algebra, switching equations, simplification of logic circuits.
2. Design and implement combinational logic circuits such as decoders, multiplexers, adders, subtractors etc.
3. Understand, explain and implement the principles of sequential circuits.
4. Design and implement sequential logic circuits such as different types of latches, flip flops, counters, registers.
5. Demonstrate an understanding of the concept of modelling the digital systems, design, construct and analyze state diagrams for synchronous sequential circuits.

Pre-requisites : Basic electronics engineering, basics of digital circuits

Unit - I 10 Hours

Principles of Combinational Logic-I: Introduction to Boolean algebra, classification of Boolean equations (switching equations), SOP and POS equations, minterms, maxterms, standard SOP and POS equations, generation of switching equations from truth tables. Completely specified functions and incompletely specified functions. Simplification methods of switching equations. Karnaugh maps-3 and 4 variables, map entered variables.

Unit - II 10 Hours

Design and Implementation of Combinational Logic: General approach, decoders-BCD decoders, encoders. Digital multiplexers- using multiplexers as Boolean function generators. Adders and subtractors - cascading full adders, look ahead carry, binary comparators.

Unit - III 10 Hours

Principles of Sequential Circuits-I: Introduction to Sequential Circuits, basic bi-stable element, latches, SR latch, applications of SR latch, S' R' latch, gated SR latch, gated D latch. Master-slave flip-flops- pulse-triggered flip-flops, master-slave SR flip-flops, master-slave JK flip-flop.

Edge triggered flip-flop- Positive edge-triggered D flip-flop, negative-edge triggered D flip-flop-characteristic equations, registers, classification and universal shift register.

Unit - IV **10 Hours**

Principles of Sequential Circuits-II: Counters - Binary ripple counters, synchronous binary counters, counters based on shift registers, design of a synchronous counters, design of a synchronous mod-6 counter using clocked JK flip-flops, design of a synchronous mod-6 counter using clocked D, T, or SR flip-flops.

Self learning topics: Design of Synchronous counters

Unit - V **10 Hours**

Design and Implementation of Sequential Logic: Introduction, Mealy and Moore models, state machine notation, synchronous sequential circuit analysis and design. Analysis of clocked synchronous sequential circuits, excitation and output expressions, transition equations, transition tables, excitation tables, state tables, construction of state diagrams, counter design.

Text Books

1. Sudhakar Samuel, **"Logic Design"**, Pearson/Sanguine, 2010 reprint.
2. John M Yarbrough,**"Digital Logic Applications and Design",**Thomson Learning, 2016 reprint.

Reference Books

1. Donald D Givone, **"Digital Principles and Design",** TMH publications, 2015 reprint.

E-Resources: https://nptel.ac.in/course.php

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Explain** and **apply** the principles of combinational Logic with knowledge of Boolean algebra, switching equations, simplification techniques and minimization of logic circuits**.**	L2, L3
2. **Design, analyze** and **implement** combinational logic circuits such as decoders, multiplexers, adders, subtractors etc.	L3, L4
3. **Explain** and **apply** the principles of sequential circuits.	L2, L3
4. **Design, analyze** and **apply** sequential logic circuits such as different types of latches, flip flops, counters, registers.	L2, L4
5. **Explain** the concept of modelling the digital systems, design, **construct and analyze** state diagrams for synchronous sequential circuits.	L2, L3, 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.	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. **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. Chalk Board
2. Power Point Presentations

Assessment methods

1. Internal Assessment Tests
2. Quiz/Seminar/Course Project
3. Assignments
4. Semester End Examination

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 LABORATORY

Course Code	18EEL36	**Credits**	1
Course type	PC	**CIE Marks**	25
Hours/week: L-T-P	0-0-2	**SEE Marks**	25
Total Hours:	36	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

To impart an ability to the students to

1. Understand and demonstrate characteristics of basic solid state Electronic components. (BJT and FET)
2. Analyze and demonstrate the applications of basic Solid state Electronic components such as diodes (Clippers & Clampers), BJT (transistors) and FET's (Amplifiers and Oscillators).

Pre-requisites : Basic Electronics

List of Experiments

1. Design and Testing of Clipper circuits using diodes.
2. Design and Testing Clamper Circuits using Diodes and passive elements.
3. Design of DC voltage Regulator using IC 78xx series.
4. Determination of Bipolar Junction Transistor Characteristics.
5. Design and Testing of RC coupled Single stage BJT amplifier and determination of band-width from the gain-frequency response.
6. Design and Testing of BJT Darlington Emitter follower and determination of input and output impedances.
7. Design and Testing of R-C phase shift Oscillator using BJT and Passive components.
8. Demonstration of characteristics of JFET.

Text Books

1. Robert L. Boylestad and Louis Nashelsky"Electronic Devices and Circuit Theory", PHI.9th Edition 2011
2. Albert Malvino& David J Bates, "Electronic Principles", 7th Edition, TMH, 2007.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Demonstrate characteristics of Solid State Electronic components namely BJT and FET.	L3, L4
2. Demonstrate applications of Solid state Electronic components namely clippers, clampers, amplifiers, oscillators.	L3, 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.	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 specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.	PO3
4. Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.	PO4
5. **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

Assessment methods

1. Conduction evaluation
2. Journal evaluation
3. Open end experiment
4. SEE

Scheme of Continuous Internal Evaluation (CIE):

Components	Attendance/conduct of lab	Journal	Open End Experiment	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		

LOGIC DESIGN LAB

Course Code	18EEL37	**Credits**	1
Course type	PC	**CIE Marks**	25 marks
Hours/week: L-T-P	0-0-2	**SEE Marks**	25 marks
Total Hours:	36	**SEE Duration**	3 hours for 50 marks

Course learning objectives

To impart ability an ability to the students to

1. Demonstrate an understanding of referring specifications of IC chips of NAND, NOR gates and trainer kits.
2. Explain simplification and realization of Boolean expressions using logic gates and universal gates.
3. Understand the design, operation and analysis of combinational and sequential logic circuits.

Pre-requisites : Basic electronics engineering, basics of digital circuits

List of experiments

1. Logic gates/universal gates Truth Table Verification. Design and implementation of arithmetic circuits namely half/full adder and half/full subtractors using logic gates.
2. i. Realization of parallel adder/subtractors using IC 7483 chip.
   ii. BCD to excess-3 code conversion and vice versa.
3. Realization of binary to gray code conversion and vice versa.
4. Multiplexer and demultiplexer – use of ICs 74153, 74139 for the implementation of arithmetic circuits and code converter.
5. Realization of one/two bit comparator and study of 7485 magnitude comparator.
6. Use of decoder chip to drive LED display.
7. Realization of 3 bit counters as a sequential circuit and mod – N counter design and two bit UP/DOWN counter design (using ICs 7476, 7490, 74192, 74193).
8. Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using IC 7495.
9. Ring counter design.
10. Open end experiment on case studies of theory.

Text Books

1. Sudhakar Samuel, **"Logic Design",** Pearson/Sanguine.
2. John M Yarbrough, **"Digital Logic Applications and Design",** Thomson Learning.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Justify** an understanding of referring specifications of IC chips of NAND, NOR gates, trainer kits.	L2
2. **Explain** the simplification and realization of Boolean expressions using logic gates and universal gates.	L3
3. **Demonstrate** the **design, operation and analysis** of Combinational and sequential logic circuits.	L2,L3,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.	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. **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
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.	PO12

Assessment methods

1. Conduction evaluation
2. Journal evaluation
3. Open end experiment
4. SEE

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		

ELECTRICAL MEASUREMENT AND CIRCUIT SIMULATION LABORATORY

Course Code	18EEL38	**Credits**	1
Course type	PC	**CIE Marks**	25
Hours/week: L-T-P	0-0-2	**SEE Marks**	25
Total Hours:	36	**SEE Duration**	3 hours for 50 marks

Course learning objectives:

To impart an ability to the students to

1. Measure the various parameters in electrical systems namely voltage, current, power, energy, resistance, inductance and capacitance etc.
2. Perform the Calibration of measuring instrument.
3. Utilize the software package for designing the electronics circuits.

List of Experiments

1. Measurement of low resistance using Kelvin's double bridge.
2. Measurement of capacitance & inductance using De-Sauty bridge & Maxwell's bridge.
3. Determination of percentage error of three phase energy meter.
4. Measurement of power factor in single phase circuit using three voltmeter method.
5. To design and simulate an op-amp based inverting & non inverting amplifier using software simulation package.
6. To design and simulate RC phase shift oscillator & RC coupled amplifier using op-amps by using software simulation package.
7. To design and simulate diode shunt clipper and diode clamper circuit simulation using software simulation package.
8. To design and simulate inverting and non inverting Schmitt trigger circuit using software simulation package.

Reference Books

1. A. K. Sawhney, **"Electrical and Electronic Measurements and Instrumentation",** Publisher-Dhanpatrai and Sons, New Delhi.
2. Cooper D. and A. D.Helfrick, **"Modern Electronic Instrumentation and MeasurementTechniques,"** Publisher-PHI.

Course Outcome (COs):

At the end of the course, students will be able to	**Bloom's Level**
1. **Demonstrate** and **analyze** the measurement technique for resistance, inductance and capacitance	L2, L4
2. **Explain, demonstrate** and **analyze** the calibration methods for measuring instruments.	L2, L4
3. **Explain** and **demonstrate** the use of transducers/sensors for measurement of non-electrical quantities.	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.	**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.	PO3
4.	Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.	PO4
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.	PO5
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.	PO12

Assessment methods

1. Conduction evaluation
2. Journal evaluation
3. Open end experiment
4. SEE

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		

4th semester B.E. (E&E)

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

Course Code	18MATEE41	**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

To impart an ability to the students to

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.

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.
Students will acquire	
1. An ability to apply knowledge of mathematics, science and engineering.	PO1
2. Identify, formulate, research literature and analyze complex engineering problems, reaching substantiated conclusions using first principles of mathematics, natural Sciences and Engineering. Sciences	PO2
3. 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.	PO5

Course delivery methods	Assessment methods
1. Black Board Teaching	1. Internal Assessment
2. Scilab	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 test is compulsory.
- **Minimum marks required to qualify for SEE: 20 out of 50**

Scheme of Semester End Examination (SEE):

It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.

Minimum marks required in SEE to pass: 40 out of 100 marks

Question paper contains10 questions each carrying 20 marks. Students have to answer FIVE full questions selecting at least one from each unit.

Vector Calculus, Laplace Transforms and Probability

(For Diploma Mech, Civil, E&C, E&E, Aero)

Course Code	18DMATEE41	**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

To impart an ability to students to:

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, Gauss 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.

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.
Students will acquire	
1. An ability to apply knowledge of mathematics, science and engineering.	PO1
2. Identify, formulate, research literature and analyze complex engineering problems, reaching substantiated conclusions using first principles of mathematics, natural Sciences and Engineering. Sciences	PO2
3. 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 Tests
2. Power point presentation	2. Assignments
3. Scilab/ Matlab/ R-Software	3. Quizes

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 test is compulsory.

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

Scheme of Semester End Examination (SEE):

* Question paper contains 10 questions each carrying 20 marks. Students have to answer FIVE full questions.

  Minimum marks required in SEE to pass: 40 out of 100 marks.

* It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.

ELECTRIC POWER GENERATION, TRANSMISSION AND DISTRIBUTION

Course Code	18EE42	**Credits**	4
Course type	PC	**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

To impart an ability to the students to

1. Explain the aspects of site selection, classification, layout, construction and operation, merits and demerits of hydro, thermal, nuclear, wind, solar power generation.
2. Understand and explain the general layout of power system, standard voltages for generation, transmission and distribution levels, DC and AC transmission.
3. Describe the components of transmission systems, mechanical aspects, insulators, underground cables, corona, line parameters and performance calculations.
4. Demonstrate an understanding of general DC and AC distribution system, radial & ring main systems, estimation for concentrated loads and uniform loads.

Pre-requisites : Basic electrical engineering

Unit - I 10 Hours

Sources of Electrical Power: Wind, solar, fuel, tidal, geo-thermal, bio generation, diesel, gas, (block diagram approach only), concept of distributed generation.

Hydro Electric, Thermal & Nuclear power plants- Layout, explanation and comparison

Unit - II 10 Hours

Typical Transmission & Distribution Systems: General layout of power system, transmission and distribution, advantages of AC and DC high voltage transmission, effect of high voltage transmission on line efficiency and line drop, components of distribution system.

Mechanical Design of Overhead Transmission Lines-Types of supporting structures and line conductors used, sag and tension calculation- supports at the same and different levels, effect of wind and ice, sag at erection, stringing chart and line vibrators, numerical

Unit - III 10 Hours

Line Parameters: Structure of Power System - Parameters of single and three phase transmission lines with single and double circuits -Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition - application of self and mutual GMD; skin and proximity effects -Typical configurations, numericals

Insulators: Introduction, ratings, types of insulators, voltage distribution across suspension insulators, string efficiency & methods to improve string efficiency

Self Learning Topics: Double Circuits, Transposition & related derivations

Unit - IV **10 Hours**

Performance of Power Transmission Lines-Short transmission lines, medium transmission lines- nominal T, end condenser and π models, long transmission lines-, ABCD constants of transmission lines, Ferranti effect, line regulation, numerical.

Underground Cables: Insulating materials, insulation resistance, grading of cables: Capacitance grading, intersheath grading, dielectric loss

Self Learning Topics: Underground Cables

Unit - V **10 Hours**

Distribution Systems-General DC and AC distribution system, radial & ring main systems, calculation for concentrated loads and uniform loading, numericals.

Text Books

1. A. Chakrabarti, M. L. Soni, and P.V. Gupta, **"Power System Engineering",** Dhanpat Rai and Co., New Delhi.
2. C. L. Wadhwa, **"Generation, Distribution and Utilization of Electrical Energy",** New Age International, 3rd Edition.
3. V.K.Mehta, Rohit Mehta, **"Principles of Power System",** S Chand & Co, 2004 Edition

Reference Books

1. S. N. Singh, **"Electric Power Generation, Transmission and Distribution",** P.H.I., New Delhi, 2nd Edition.
2. Dr. S. L. Uppal, "**Electrical Power",** Khanna Publications.

E-Resource: https://nptel.ac.in/courses/108105067/3

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Explain** the aspects of site selection, classification, lay out, construction and operation, merits and demerits of hydro, thermal, nuclear, wind and solar power generation.	L2
2. **Analyze** the general layout of power system, list the standard voltages for generation, transmission, distribution levels, DC and AC transmission.	L1, L4
3. **Explain** the components of transmission systems, mechanical aspects, insulators, underground cables, corona, line parameters and performance **calculations**.	L2, L5
4. **Explain** general DC and AC Distribution system, radial & ring main systems, **calculation** for concentrated loads and uniform loading.	L2, 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.	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.	**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. Chalk Board
2. Power Point Presentations
3. Field Visits

Assessment methods

1. Internal Assessment Tests
2. Quiz/Seminar/Course Project
3. Assignments
4. Semester End Examination

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.

SYNCHRONOUS AND INDUCTION MACHINES

Course Code	18EE43	**Credits**	4
Course type	PC	**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

To impart an ability to the students to

1. Demonstrate an understanding of the principle of operation, types, construction, working, equivalent circuit models, phasor diagrams, performance calculations of synchronous machines.
2. Describe the principle of synchronization, synchronizing methods, power flow equations, variable excitation and constant excitation operation.
3. Explain the principle of operation of synchronous motor, starting methods, equivalent circuit, phasor diagrams, torque angle, effect of change in excitation and change in load, hunting and applications of synchronous motors.

Pre-requisites : Basic electrical engineering

UNIT-I 10 Hours

Synchronous Generators - Principle of operation, construction of three phase salient & non-salient pole synchronous machines, advantages of stationary armature, excitation systems, generated EMF, armature windings, distribution factor and chording (pitch) factor, harmonics-causes, reduction and elimination. Expression for n^{th} order harmonic induced emf per phase, leakage reactance, armature reaction, synchronous reactance, equivalent circuit and phasor diagram of non-salient type alternator.

Voltage Regulation: Voltage regulation by EMF, MMF, ZPF methods, definition and significance of short circuit ratio, salient pole alternators-two reaction model, direct and quadrature axis reactances, slip test, phasor diagrams on load and voltage regulation.

UNIT-II 10 Hours

Synchronization of Alternators: Synchronizing to infinite bus, necessity and conditions for synchronization, synchronization using lamp methods and synchroscope, power angle characteristics, operation for fixed input and variable excitation, power flow equations including armature resistance.

Synchronous Motors : Principle of operation, methods of starting synchronous motors, equivalent circuit and phasor diagrams, determination of excitation emf and torque angle, effect

of change in excitation, V and inverted V curves, effect of change in load, causes of hunting, its effects and reduction and applications of synchronous motors.

UNIT-III **10 hours**

Three Phase Induction Motors: Concept of rotating magnetic field, principle of operation, construction, types, speed and slip, frequency of rotor emf, power stages in induction motors, torque, torque-slip characteristic, motoring, generating and braking regions of operation and maximum torque.

Performance Analysis of Three Phase Induction Motor: Equivalent circuit, phasor diagram of induction motor on no-load, and on load, losses and efficiency, no-load and blocked rotor tests, circle diagram and performance evaluation of the motor, cogging and crawling.

UNIT-IV **10 hours**

High torque motors: Double cage and deep rotor bars, equivalent circuit and performance evaluation of double cage induction motor.

Induction generator: Externally excited and self-excited, advantages and applications of induction generators.

Starting and Speed Control of Three-phase Induction Motors: Need for starter, direct on line (DOL), Star-Delta and autotransformer starting, rotor resistance starting, soft(electronic) starters, speed control using voltage, frequency and rotor resistance.

UNIT-V **10 hours**

Single-phase Induction Motor: Double revolving field theory and principle of operation, types of single phase induction motors- split-phase, capacitor start, shaded pole motors and applications.

Special Electric Motors: Reluctance motors, hysteresis motors, repulsion motors, single phase AC series motor (universal motors), linear induction motors and applications.

Self-Learning Topics: Repulsion motors, single phase AC series motor, linear induction motors.

Text Books

1. Ashfaq Hussain, **"Electrical Machines"**, Dhanpat Rai & Co. Publications, third edition.
2. V. K. Mehta &Rohit Mehta, **"Electrical Machines",** S. Chand & Co. Ltd. Publications, second edition.

Reference Books

1. I. J. Nagrath and D. P. Kothari, **"Electric Machines",** TMH, 4th edition.
2. A. E. Fitzgerald, Charles Kingsley Jr. S. D. Umans, "**Electric Machinery",** TMH, 6th edition.
3. P.S Bhimbra, **"Electrical machinery",** Khanna Publishers, 2nd edition.

E-Resources: https://nptel.ac.in/course.php

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Explain** the principle of operation, types, construction, excitation systems, working, generated EMF and harmonics, reduction of harmonics, equivalent circuit models and parameters, phasor diagrams, performance calculations, **calculation** of voltage regulation by different methods for various synchronous machines.	L2, L5
2. **Illustrate** the principle of synchronization, synchronizing methods, power flow equations, variable excitation and constant excitation operation.	L2
3. **Explain** the principle of operation of synchronous motor, starting methods, equivalent circuit and phasor diagrams, torque angle, effect of change in excitation and change in load, hunting and applications of synchronous motors.	L2
4. **Explain** the construction, principle of operation, types of single phase and three phase induction motor, operating characteristics, performance and **analyze** starting methods and applications.	L2, L4
5. **Demonstrate** the principle of operation, construction, types of special electric motors and applications.	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.	PO 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.	PO 2
3. **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.	PO 12

Course delivery methods

1. Chalk Board
2. Power Point Presentations

Assessment methods

1. Internal Assessment Tests
2. Quiz/Seminar/Course Project
3. Assignments
4. Semester End Examination

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	18EE44	**Credits**	4
Course type	PC	**CIE Marks**	50
Hours/week: L-T-P	3-2-0	**SEE Marks**	50
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

To impart an ability to the students to

1. Understand and explain the concept and classification of control systems.
2. Demonstrate an understanding of formulation, construction and explanation of models of physical systems in terms of differential equations, transfer functions, block diagrams, signal flow graph.
3. Analyze the performance of feedback control systems in terms of time domain specifications.
4. Understand and explain the concept of absolute and relative Stability of Feedback control systems using R-H criterion, root locus technique, frequency domain analysis methods such as polar plots and Bodes plots.
5. Explain the concept of compensation in feedback control systems, types of compensators, controllers and their applications.

Pre-requisites: Calculus and Laplace transforms.

Unit – I 10 Hours

Modelling of Systems: Introduction to control systems, classification of control systems, open loop and close loop control systems with examples.

Differential equations of physical systems – mechanical systems- friction, translational systems (mechanical accelerometer, levered systems excluded), rotational systems, gear trains, electrical systems, analogous systems.

Unit – II 10 Hours

Block diagrams and signal flow graphs: Transfer functions, block diagrams, signal flow graphs.

Time Response of feedback control systems: Standard test signals, unit step response of first and second order systems, time response specifications (no derivations).Time response specifications of second order systems, steady – state errors and error constants.

Unit - III 10 Hours

Stability analysis: Concepts of stability, necessary conditions for Stability, Routh-Hurwitz stability criterion, relative stability analysis; special cases of RH criterion.

Root–Locus Techniques: Introduction, basic properties of root loci, construction of root loci.

Unit - IV **10 Hours**

Frequency domain Analysis: Introduction, advantages of frequency domain analysis. Correlation between time and frequency domain specifications. Polar plots, definitions of gain margin, and phase margin.

Frequency domain analysis: Bode plots, assessment of stability from Bode plot. Introduction to Matlab.

Unit - V **10 Hours**

Compensators: Design of lead, lag, lag lead compensators and applications.

Controllers: Proportional, Proportional derivative, proportional integral and PID controller, advantages and disadvantages of each controller.

Self learning topics: PID Controllers:

Text Books

1. D Ganesh Rao, K Channa Venkatesh, **"Control Engineering",** Pearson Education edition.
2. Ashfaq Husain and Haroon Ashfaq, **"Control Systems",** Dhanpat Rai & Co First edition.
3. Anand Natarajan and P. Ramesh Babu, **"Control System Engineering" SciTech Publications.**

Reference Books

1. Norman S Nise,**"Control Systems Engineering"**, Wiley Student Edition, fifth Edition.
2. I. J. Nagarath and M.Gopal, "**Control Systems Engineering",** New Age International (P) Limited, fourth Edition.
3. Benjamin C.Kuo and FaridGolnaaghi, **"Automatic Control Systems"**, Wiley Student Edition.

E-Resources: https://nptel.ac.in/course.php

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Explain** the concept and **classification** of control systems.	L2
2. **Formulate**, **construct** and **explain** models of physical systems in terms of differential equations, transfer functions, block diagrams, signal flow graph.	L3, L4
3. **Explain** and **analyze** performance of feedback control systems in terms of Time domain specifications.	L2, L4
4. **Explain** the concept of absolute and relative Stability of feedback control systems using R-H criterion, Root locus technique, frequency domain **analysis** methods such as polar plots and Bodes plots	L2, L4
5. **Explain** the concept of compensation in feedback control systems, types of compensators, functions of PID controllers and their applications.	L2,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.	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
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.	PO12

Course delivery methods

1. Chalk Board
2. Power Point Presentations

Assessment methods

1. Internal Assessment Tests
2. Quiz/Seminar/Course Project
3. Assignments
4. Semester End Examination

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, SYSTEMS & PROCESSING

Course Code	18EE45	**Credits**	4
Course type	PC	**CIE Marks**	50
Hours/week: L-T-P	3-2-0	**SEE Marks**	50
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

To impart an ability to the students to

1. Demonstrate an understanding of the definition, classification of the signals, properties of systems and their response.
2. Learn the concept and applications of Z transform and Discrete Fourier Transform tools.
3. Demonstrate and understand the realization of digital systems, block diagrams realization of IIR systems and FIR systems of different forms.
4. Get acquainted with Concept and applications Fast Fourier transforms algorithms.
5. Understand and interpret the applications and design of IIR and FIR filters.

Pre-requisites: Calculus, Laplace Transformation, Z transforms.

Unit - I **10 Hours**

Basic of Signals and Systems: Definition of signals and a system, classification of signals and types. Basic operations on signals-Amplitude scaling, addition, multiplication, time shifting, time scaling. Properties of systems.

4 Hours

Linear Time Invariant Systems- Impulse response and system properties using Impulse response, Convolution sum, Convolution integral.

6 Hours

Unit - II **10 Hours**

Z- Transform-Introduction, properties of Region of Convergence (ROC), properties of Z-transforms, Z transform problem, inverse Z-transform by partial fraction expansion method, System Transfer function, System stability and causality.

Self learning topics: Z-transform by partial fraction expansion method.

Unit - III **10 Hours**

Discrete Fourier Transforms: Definitions, properties-Periodicity, circular time shift, circular frequency shift, circular folding, and multiplication in time domain.

6 Hours

Realization of digital systems: Introduction, block diagrams, realization of IIR systems-direct form, cascaded, parallel form, realization of FIR systems – direct form, cascade form.

4 Hours

Unit - IV **10 Hours**

FFT and Algorithms: Introduction, decimation in time algorithm, first decomposition, continuation of decomposition, number of multiplications, and decimation in frequency algorithms, inverse decimation in time and inverse decimation in frequency algorithms

6 Hours

Fast convolution techniques - overlap add and overlap save methods.

4 Hours

Unit - V **10 Hours**

Design of IIR digital filters: Introduction, bilinear transformations, design of analog filters- Butterworth filter & Chebyshev filter.

6 Hours

Introduction to FIR digital filters: Design of linear FIR filter using rectangular window, Hanning window, Hamming window with an example.

4 Hours

Self learning topics: Study of analog and digital filters

Text Books

1. Simon Haykin and Barry Van Veen, "Signals and Systems", John Wiley & Sons publishers fourth edition, 2006.
2. John G Proakis, Dimitris G. Manolakis, "Digital Signal Processing Principle, Algorithm & application", Pearson publishers, fourth edition, 2007.

Reference Books

1. Alan V Oppenheim, Alan S. Willsky and S. Hamid Nawab, "Signals and Systems", Pearson publishers, second edition, 1996.
2. Udaykumar S , "Signals and Systems", Elite publishers, fourth edition, 2005.
3. Michael Roberts, Govind Sharma, "Fundamentals of Signals and Systems", McGraw Hill Education, second edition, 2017.
4. Sanjeet. K. Mitra, "Digital Signal Processing", TMH Publishers, fourth edition, 2013.
5. Charles L. Phillips - John M. Parr, Eve A. Riskin, "Signals, Systems, and Transforms", Pearson; fourth edition, 2017

E-Resources: https://nptel.ac.in/course.php

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Explain** the definition, types and properties of Systems and Signals and response of systems and their properties.	L2
2. **Explain** and **apply** Z transform and Discrete Fourier transform tools	L2, L3
3. **Explain** and **apply** Realization of Digital systems, block diagrams and SFGs, realization of IIR systems and FIR systems of different forms.	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.	Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.	PO4
4.	**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	PO5

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. PO10

Course delivery methods

1. Chalk Board
2. Power Point Presentations

Assessment methods

1. Internal Assessment Tests
2. Quiz/Seminar/Course Project
3. Assignments
4. Semester End Examination

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 atleast one full question from each unit.

LINEAR IC's &APPLICATIONS LABORATORY

Course Code	18EEL46	**Credits**	1.5
Course type	PC	**CIE Marks**	25 marks
Hours/week: L-T-P	0-0-3	**SEE Marks**	25 marks
Total Hours:	36	**SEE Duration**	3 hours for 50 marks

Course learning objectives

To impart ability in students to

1. Design and implement different linear IC circuits
2. Design and implement different non- linear IC circuits
3. Implement and explain 555 Timer Circuits
4. Design and implement filters.

Pre-requisites : Basics of Analog Electronics

List of experiments

1. Design and implementation of capacitor coupled inverting and non-inverting amplifier with single polarity supply using 741 Op amp.
2. Design and implementation of Non Saturating Precision half wave rectifier and high impedance precision full wave rectifier, using 741 Op amp.
3. Design and implementation of Clippers and Clampers circuits using741 Op amps.
4. Design and implementation of differentiator and integrator using 741 Op amp.
5. Design and implementation of square wave generator/ triangular wave generator using 741 Op amps.
6. Design and implementation of RC phase shift oscillator using 741 Op-amp.
7. Design and implementation of mono-stable and astable multivibrator using Op-amp
8. Design and implementation of first order and second order low pass filter using op-amps.
9. Design and implementation of first order and second order high pass filter using op-amps.
10. Design and implementation of mono-stable and astable multivibrator using 555 timer.

Text Books

1. David A Bell, "Operational amplifiers and Linear IC's", Prentice Hall, third edition.
2. Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits", Prentice Hall, fourth edition.
3. Robert F Couglin, Frederick F Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Prentice Hall, sixth edition.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Demonstrate an understanding of specifications of Linear ICs.[	L2
2. Explain and demonstrate operation and applications of Linear ICs	L2,L3,L4
3. Demonstrate determination of performance characteristics of Linear ICs	L2,L3
4. Analyze the performance of linear IC circuits referring the experimental results.	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.	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
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.	PO10
5. 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

Assessment methods

1.Conduction evaluation
2.Journal evaluation
3.Open end experiment
4. SEE

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		

ELECTRICAL MACHINES LABORATORY

Course Code	18EEL47	**Credits**	1.5
Course type	PC	**CIE Marks**	25 marks
Hours/week: L-T-P	0-0-3	**SEE Marks**	25 marks
Total Hours:	36	**SEE Duration**	3 hours for 50 marks

Course learning objectives

To impart ability in students to

1. Demonstrate an understanding of specifications of Electrical machines.
2. Explain and demonstrate operation of the Electrical machines.
3. Demonstrate determination of performance characteristics the Electrical machines experimentally.
4. Analyze the performance of the machines referring the experimental results.

List of experiments

1. Load test on a DC shunt motor- determination of speed-torque and HP-efficiency characteristics. Verify the results using MATLAB Simulink.
2. Speed control of DC motor by armature voltage control and flux control.
3. Estimate the efficiency and regulation of transformer using Sumpner's test. Verify the results using MATLAB Simulink.
4. Estimate the efficiency of 3 phase induction motor by load Test on of 3 phase induction motor. Verify the results using MATLAB Simulink.
5. Predetermination of performance of induction motor using circle diagram.
6. Performance of synchronous generator connected to infinite bus, under constant power and variable excitation.
7. V and inverted V curves of a synchronous motor.
8. Voltage regulation of an alternator by EMF, MMF and ZPF method.

Text Books

1. Ashfaq Hussain, **"Electrical Machines"**, Dhanpat Rai & Co. Publications, third edition.
2. V. K. Mehta &Rohit Mehta**, "Electrical Machines",** S. Chand & Co. Ltd. Publications, second edition.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Demonstrate** an understanding of specifications of electrical machines.	L3
2. **Explain** and **demonstrate** operation of the electrical machines.	L2,L3
3. **Demonstrate** and **determine** of performance characteristics the electrical machines experimentally.	L3
4. **Analyze** the performance of the machines referring the experimental results.[	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.	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.	Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.	PO4
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.	PO11
5.	**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

Assessment methods

1. Conduction evaluation
2. Journal evaluation
3. Open end experiment
4. SEE

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		

SIGNALS, SYSTEMS AND PROCESSING LAB

Course Code	18EEL48	**Credits**	1
Course type	PC	**CIE Marks**	25 marks
Hours/week: L-T-P	0-0-2	**SEE Marks**	25 marks
Total Hours:	36	**SEE Duration**	3 hours for 50 marks

Course learning objectives

To impart an ability in students to

1. Demonstrate an understanding of availability of various tools in MATLAB.
2. Explain and demonstrate operation and applications of DSP, Simulink tools.
3. Create platform for the performance analysis of the various systems.
4. Design the simulation models for various analog filters.

Pre-requisites: Signals and systems, Applications of engineering mathematics.

List of experiments

1. Representation of basic Signals using MATLAB (Introduction).
2. Discrete Convolution using MATLAB
   a) Linear convolution
   b) Circular convolution
3. Fast Fourier Transform using MATLAB.
4. Analog filters design using MATLAB.
   a) Butterworth
   b) Chebyshev
5. Convolution using overlap add and overlap save method.
6. Realization of IIR Digital filters using,
   a) Direct form I & II
   b) Parallel Realization and
   c) Cascade form
7. FIR filter design using window techniques a) Rectangular b) Bartlett c) Blackman d) Chebyshev e) Hamming f) Hanning g) Kaiser.
8. Realization of FIR Digital filters using,
   a) Non linear phase filter
   b) Linear phase filter

Text Books

1. RudraPratap, "Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers Paperback", Oxford Publishers.
2. Simon Haykin and Barry Van Veen, "Signals and Systems", John Wiley & Sons publishers fourth edition, 2006.
3. John G Proakis, Dimitris G. Manolakis, "Digital Signal Processing Principle, Algorithm & application", Pearson publishers, fourth edition, 2007.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Demonstrate** an understanding of tools in MATLAB	L3
2. **Explain** and **demonstrate** operation and applications of DSP, Simulink tools.	L2,L3
3. **Design** and **demonstrate** the filters and its applications.	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.	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
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.	PO10
5. **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

Assessment methods

1. Conduction evaluation.
2. Journal evaluation.
3. Open end experiment.
4. SEE.

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:	18EE49	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)

To impart an ability in students to

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 **06 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 **06 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 **06 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 **05 Hours**

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

UNIT V 05 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

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).
5. Harsh K. Gupta, "**Disaster Management**", Universities Press (India) Pvt. Ltd (2003).

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. 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.	PO6
2. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7

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			