22EE310	Numerical Methods and Complex Variables

Category	L	T	P	Credit
BSC	3	1	0	4

Preamble

An Electrical engineering student needs to know sufficient numerical tools and techniques for solving engineering problems arises in their field. This course aims at developing the ability to formulate an engineering problem in a mathematical form appropriate for subsequent computational treatment and to choose an appropriate numerical approach. Analytic functions and Contour integration are extremely important while creating engineering models in control systems, communication systems, searching algorithms. The course is designed to impart the knowledge and understanding of the above concepts to Electrical Engineers and apply them in their areas of specialization.

Prerequisite

- NIL

Course Outcomes

On the successful completion of the course, students will be able to

COs	Course Outcomes	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Solve single non-linear algebraic, transcendental equation numerically.	TPS3	80	75
CO2	Solve system of linear equations numerically	TPS3	80	75
CO3	Solve the initial value problems in ODE numerically using single step and multi-step methods.	TPS3	80	75
CO4	Solve the boundary value problems in PDE using finite difference methods.	TPS3	80	75
CO5	Construct complex potential function and observe the behaviour using conformal mapping.	TPS3	75	70
CO6	Determine the value of integrals of functions of complex variable .	TPS3	75	70

Mapping with Programme Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2

CO1	**S**	**S**	**M**	**M**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**M**	**S**	**S**
CO2	**S**	**S**	**M**	**M**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**M**	**S**	**S**
CO3	**S**	**S**	**M**	**M**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**M**	**S**	**S**
CO4	**S**	**M**	**M**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**M**	**S**	**S**
CO5	**S**	**M**	**M**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**M**	**S**	**S**
CO6	**S**	**M**	**M**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**M**	**S**	**S**

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Assessment 1						Assessment 2						Terminal(%)		
	Written Test 1			Assignment 1			Written Test 2			Assignment 2					
TPS	R	U	A	R	U	A	R	U	A	R	U	A	R	U	A
CO1	21%			100%									10%		
CO2	21%												10%		
CO3	33%												17%		
CO4	25%												13%		
CO5							50%			100%			25%		
CO6							50%						25%		
TOTAL															

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Solution to a Single Non-linear Equation and a System of Linear Equations: Introduction to Numerical Solution – The Bisection Method - Fixed point iteration method – Newton Raphson method – Crout's Decomposition Method - Gauss Jacobi Method – Gauss Seidel methods

Numerical Solution of ODEs: Euler's method – Modified Euler's method – Taylor's Method- Runge-Kutta methods of order 4 – Predictor corrector methods – Adam's predictor corrector formula – Milne's Predictor corrector formula. **Numerical Solution of PDEs:** Classification of Second order equation - Solution to Elliptic, Parabolic and Hyperbolic PDEs

Complex Differentiation: Functions of complex variable – Analytic functions – C-R equations – Conjugate harmonics – Standard Transformations – Conformal Transformations – z^2, 1/z, az+b – Bilinear Transformations

Complex Integration: Cauchy's Theorem - Cauchy's integral formula – Taylor's Series - Laurent's series – Zeros of Analytic function – Singularities - Residues — Cauchy's residue theorem – Contour Integration.

Text Books

1. Steven C. Chapra, Raymond P. Canale, "Numerical Methods for Engineers", 7th Edition, McGrawHill Higher Education,2016.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2012.

Reference Books & web resources

1. Richard L Burden and Douglas J Faires, "Numerical Analysis", Thomas Learning, New York, 2017.
2. Ward Cheney and David Kincaid, "Numerical Mathematics and Computing", Cengage Learning, USA, 2018.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley, 10th Edition, 2017
4. Mathews J. H. and Howell R. W, "Complex Analysis for Mathematics and Engineering", Narosa Publishing House, New Delhi, 2012

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	**Solution to a Single Non-linear Equation and a System of Linear Equations**	
1.1	Introduction to Numerical Solution	1
1.2	The Bisection Method	1
1.3	Fixed point iteration method	1
	Tutorial	**1**
1.4	Newton Raphson method	1
1.5	Crout's Decomposition Method	2
	Tutorial	**1**
1.6	Gauss Jacobi Method	1
1.7	Gauss Seidel methods	1
2	**Numerical Solution of ODEs and PDEs**	

Module No.	Topic	No. of Periods
2.1	**Numerical Solution of ODEs** : Euler's method and Modified Euler's method	1
	Tutorial	**1**
2.2	Taylor's Method	1
2.3	Runge-Kutta methods of order 4	2
	Tutorial	**1**
2.4	Predictor corrector methods	1
2.5	Adam's and Milne's predictor corrector formula	1
2.6	**Numerical Solution of PDEs:** Classification of Second order equation	1
	Tutorial	**1**
2.7	Solution to Elliptic PDEs	2
2.8	Solution to Parabolic PDEs	1
	Tutorial	**1**
3	**Complex Differentiation**	
3.1	**Complex Differentiation** Functions of complex variable	1
3.2	Analytic functions – C-R equations	2
	Tutorial	**1**
3.3	Conjugate harmonics	1
3.4	Standard Transformations	1
	Tutorial	**1**
3.5	Conformal Transformations – z^2, 1/z, az+b	2
3.6	Bilinear Transformations	2
	Tutorial	**1**
4	**Complex Integration**	
4.1	**Complex Integration:** Cauchy's Theorem and Cauchy's integral formula	2
4.2	Taylor's Series - Laurent's series	2

Module No.	Topic	No. of Periods
	Tutorial	**1**
4.3	Zeros of Analytic function and Singularities - Residues	1
4.4	Cauchy's residue theorem	2
	Tutorial	**1**
4.5	Contour Integration	3
	Total	48

Course Designer(s):

1. Dr. R. Rammohanm,Professor,Mathematics rr_maths@tce.edu
2. Dr. L. Muthusubramanian , Assistant Professor, Mathematics lmsmat@tce.edu
3. Dr. S. Suriyakala, Assistant Professor, Mathematics ssamat@tce.edu

22EE320 DC MACHINES & TRANSFORMERS

Category	L	T	P	Credit
PCC	2	1	0	3

Preamble

The course aims in imparting fundamental knowledge of construction, types, Operation of Transformers and Direct current (DC) machines. DC machine is a highly versatile energy converting device. They can be designed to give a wide variety of voltage-current or speed- torque characteristics for both dynamic and steady-state operation. Due to their flexibility in speed control, DC motors are widely used in applications requiring a wide range of motor speeds or precise control of motor output. A transformer is a device used to transfer electrical energy from one circuit to another. It changes electricity from one level to other level of voltage using the properties of electricity.

Prerequisite

22EE230 : Electric Circuit Analysis

Course Outcomes

On the successful completion of the course, students will be able to

CO	Course Outcome (CO)	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the construction, principle of operation and various types of DC machines.	TPS2	80%	70%
CO2	Determine the characteristics and performance of DC machines at loaded conditions.	TPS3	70%	60%
CO3	Choose the starting methods, speed control, and testing methods DC Motors.	TPS3	80%	70%
CO4	Explain the basic principles and construction of single phase, three phase transformer and application specific transformers	TPS2	80%	70%
CO5	Illustrate the operation of transformer at no load and loaded conditions	TPS3	80%	70%
CO6	Determine the performance of the given single transformer using equivalent circuit diagram and testing methods	TPS3	70%	60%

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO7.	**M**	**L**						**M**		**M**			**M**		
CO8.	**M**	**L**						**M**		**M**			**M**		
CO 3	**S**	**M**	**L**	**L**				**M**		**M**			**S**		
CO 4	**S**	**M**	**L**	**L**				**M**		**M**			**S**		
CO 5	**M**	**L**						**M**		**M**			**M**		
CO 6	**S**	**M**	**L**	**L**				**M**		**M**			**S**		

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT 1			CAT 2			ASSIGNMENT 1				ASSIGNMENT 2				TERMINAL			
TPS SCALE	1	2	3	1	2	3	3	4	5	6	3	4	5	6	1	2	3	4
CO1	**8**	16													4	8		
CO2	6	8	20				50								4	8	10	
CO3	6	16	20				50								2		10	
CO4				**8**	16										4	8		
CO5				6	8	20					50				4	8	10	
CO6				6	16	20					50				2	8	10	
	20	40	40	20	40	40									20	40	40	

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

DC Generators

Construction-Principle of operation, Emf equation-types, Armature reaction-commutation, Characteristics of generators, Losses & efficiency, Regulation, parallel operation, Applications

DC Motors

Principle of operation, Torque equation, Types-characteristics, Losses-Efficiency, Speed control and starters, Swinburne's Test , Heat run Test ,Hopkinson's Test

Transformers

Transformer construction and principle, Ideal Transformer, EMF equation, Transformer on no load & load Losses, efficiency and regulation, All day efficiency, Auto transformer, three phase transformer connections, Parallel operation of Transformers, Welding transformers, Tap changers on load & off load , OC&SC Test on transformers, Sumpners Test

Text Book

1. D.P.Kothari & I.J.Nagrath, " Electrical Machines", Tata-McGrawhill, Newdelhi, 5th Edition, 2010.

Reference Books& web resources

1. R.K.Rajput, " Electrical Technology", Laxmi Publications, 3rd edition, 2005.

2. Vincent Deldoro ," Electromechanical Energy Conversion " PHI III edition,

3. M.G.Say, Theory and performance of electrical machines, Tata-Mcgraw hill

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	**DC Generators**	
1.1	Construction- Principle of operation	2
1.2	EMF equation	1
1.3	Types & Characteristics of generators	1
1.4	Armature reaction-commutation	1
1.5	Losses & efficiency, Condition for Maximum Efficiency	2
1.6	Regulation,	1
1.7	Parallel operation, Applications	2
2	**DC Motors**	
2.1	Principle of operation	1
2.2	Torque equation	1
2.3	Types-characteristics	2
2.4	Losses-Efficiency	2
3	**Control & Testing of DC Machines**	
3.1	Speed control and starters	2
3.2	Swinburne's Test , Heat run Test ,Hopkinson's Test	2
4	**Transformer**	
4.1	Transformer construction and principle	2
4.2	Ideal Transformer	1

Module No.	Topic	No. of Periods
4.3	EMF equation	1
4.4	Auto transformer, three phase transformer connections, , Welding transformers	2
5	**Transformer Performance**	
5.1	Transformer on no-load & load Losses	2
5.2	Voltage Regulation, Tap changers on load & off load	2
5.3	Efficiency and All day efficiency	2
5.4	Parallel operation of Transformers	1
6	**Transformer Modelling & Testing**	
6.1	OC&SC Test on transformers,	1
6.2	Transformer Equivalent Circuit	1
6.3	Sumpners Test	1
	Total	36

Course Designer(s):

1. Dr.V.Saravanan, Professor, EEE vseee@tce.edu
2. Dr.S.Latha, Professor, EEE sleee@tce.edu

22EE330	LINEAR INTEGRATED CIRCUITS

Category	L	T	P	Credit
PCC	3	-	-	3

Preamble

A linear integrated circuit is a solid-state analog device characterized by a theoretically infinite number of possible operating states. It operates over a continuous range of input levels. Linear ICs are employed in audio amplifiers, Analog to Digital converters, averaging amplifiers, differentiators, DC amplifiers, integrators, multivibrators, oscillators, audio filters, and sweep generators. Some devices contain several amplifiers within a single housing.

Prerequisite

22EE260 - Electronics Circuits and devices

22EE280- Electronics Circuits and devices Lab

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the Linear Integrated Circuits fabrication techniques	TPS2	70	70
CO2	Explain the working of operation amplifier and its characteristics.	TPS2	70	70
CO3	Design linear circuits using operational amplifiers for the given specifications	TPS3	70	70
CO4	Design Multivibrator circuits using 555 timer IC	TPS3	70	70
CO5	Design voltage regulators, Analog to digital converters and Digital to Analog converters for the given specifications	TPS3	70	70
CO6	Explain the operation of Phase Locked Loop	TPS2	70	70

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	L						M		M				M
CO2	M	L						M		M				M
CO3	S	M	L	L				M		M				S
CO4	S	M	L	L				M		M				S
CO5	S	M	L	L				M		M				S
CO6	M	L						M		M				M

S- Strong; M-Medium; L-Low

Assessment Pattern: Cognitive Domain

CO	CAT 1			CAT 2			ASSIGNMENT 1				ASSIGNMENT 2				TERMINAL			
TPS SCALE	1	2	3	1	2	3	3	4	5	6	3	4	5	6	1	2	3	4
CO1	8	16													4	8		
CO2	6	8	20				50								4	8	10	
CO3	6	16	20				50								2		10	
CO4				8	16										4	8		
CO5				6	8	20					50				4	8	10	
CO6				6	16	20					50				2	8	10	
	20	40	40	20	40	40									20	40	40	

Syllabus

Introduction: Integrated circuits – Classification, Thin and thick film techniques, SMT(Surface Mount Technology) Monolithic technique - wafer preparation, Epitaxial growth, Oxidation, Photolithography, Diffusion, Ion Implantation, Isolation, Metallization and Packaging, Fabrication of Integrated resistors, capacitors and inductors - Bipolar and MOSFET devices fabrication techniques.

Operational amplifier: Basic concepts - differential amplifiers - block diagram-ideal op-amp parameters - Basic op-amp applications Scale changer, Inverting and non-inverting amplifiers, summer and subtractor, Log and antilog amplifiers - multiplier, Divider, differentiator, Integrator. Instrumentation amplifier

Op-amp circuits: V to I and I to V converters- Precision rectifier- Clipper and clamper- Sample and hold circuits - Active filters: first order and second order LPF and HPF- Comparators - Regenerative comparator (Schmitt Trigger)- Square wave and Triangular wave generators- Sine wave generators: RC Phase shift and Wein bridge oscillators.

Other Linear ICs: IC voltage regulators – Fixed and Variable voltage regulators-78XX and 79XX series regulators, LM317 voltage regulator -Switching Regulator- 555 timer IC: Astable and Monostable modes - Phase locked loop and its applications- D/A converters: weighted resistor and R-2R ladder- A/D converters: Successive approximation, Counter type, Flash type and Delta-sigma.

Text Book

1. Roy choudhury and shall B.Jain, Linear Integrated circuits, Wiley Eastern Ltd, 5th edition, 2018.

Reference Books & Web Resources

1. Ramakant A. Gayakwad, Op-amps and Linear Integrated Circuits, Pearson Education; Fourth edition, 2015
2. K.R.Botkar, Integrated Circuits, Hanna Publishers, 2008
3. Jacob Millman & Christos C.Halkias- Integrated electronics, McGraw Hill Education; 2 edition ,2017.
4. Fred F. Driscoll and Robert F. Coughlin , Operational Amplifiers and Linear Integrated Circuits, Pearson; 4 edition 1997.
5. NPTEL courses web:http://nptel.ac.in/courses/108106068/
6. MOOCs course link: https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/

Course Contents and Lecture Schedule

Module No.	Topics	No. of Periods
1	**Introduction**	
1.1	Integrated circuits – Classification	1
1.2	Thin and thick film techniques, SMT(Surface Mount Technology)	1
1.3	Monolithic technique - wafer preparation, Epitaxial growth, Oxidation	1
1.4	Photolithography, Diffusion, Ion Implantation, Isolation, Metallization and Packaging	1
1.5	Fabrication of Integrated resistors	1
1.6	Fabrication of Integrated capacitors and inductors	1
1.7	Bipolar and MOSFET devices fabrication techniques	1
2	**Operational amplifier**	
2.1	Basic concepts - differential amplifiers - block diagram-	2
2.2	ideal op-amp parameters	1
2.3	Basic op-amp applications Scale changer, Inverting and non-inverting amplifiers, summer and subtractor	1
2.4	Log and antilog amplifiers	1
2.5	multiplier, Divider,	1
2.6	differentiator, Integrator	2
2.7	Instrumentation amplifier	1
3	**Op-amp circuits**	
3.1	V to I and I to V converters	1
3.2	Precision rectifier	1
3.3	Clipper and clamper, Sample and hold circuits	1
3.4	Active filters: first order and second order LPF and HPF	2
3.5	Comparators - Regenerative comparator(Schmitt Trigger)-	1
3.6	Square wave and Triangular wave generators-	2
3.7	Sine wave generators: RC Phase shift and Wein bridge oscillators.	1
4	**Other Linear ICs**	
4.1	IC voltage regulators – Fixed and Variable voltage regulators- 78XX and 79XX series regulators,	1

4.2	LM317 voltage regulator -Switching Regulator-	2
4.3	555 timer IC - Astable and Monostable modes	2
5	**Applications**	
5.1	Phase locked loop and its applications	2
5.2	D/A converters: weighted resistor and R-2R ladder-	2
5.3	A/D converters: Successive approximation, Counter type, Flash type and Delta-sigma	2
	Total	36

Course Designers:

1. Dr.M.Saravanan Professor, EEE -mseee@tce.edu
2. Dr.S.Arockia Edwin Xavier, Associate Professor, EEE - saexeee@tce.edu

22EE340	SIGNALS AND SYSTEMS

Category	L	T	P	Credit
PCC	3	-	-	3

Preamble

This course deals the fundamentals of signal and system analysis, focusing on representations of discrete-time and continuous-time signals (singularity functions, complex exponentials and geometrics, Fourier representations, Laplace and Z transforms, sampling) and representations of linear, time-invariant systems (difference and differential equations, block diagrams, system functions, poles and zeros, convolution, impulse and step responses, frequency responses). Applications are drawn broadly from engineering, including feedback and control, communications, and signal processing.

Prerequisite

- NIL

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Identify the type of given signals and systems.	TPS2	70%	60%
CO2	Analyze the Time domain behaviour of a given Continuous time LTI system using Laplace Transform.	TPS4	70%	60%
CO3	Analyze the Time domain behaviour of a given Discrete Time LTI system using Z-Transform.	TPS4	70%	60%
CO4	Apply Fourier transform for frequency domain analysis of a given Continuous time LTI system	TPS3	70%	60%
CO5	Apply Fourier transform for frequency domain analysis of a given Discrete time LTI system	TPS3	70%	60%
CO6	Apply Discrete Fourier transform for frequency domain analysis of a given Discrete time LTI system	TPS3	70%	60%

*** Weightage depends on Bloom's Level, number of contact hours,

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	L						M		M				M
CO2	S	M	L	L	L			M		M				S
CO3	S	M	L	L	L			M		M				S

CO4	S	M	L	L				M		M				S
CO5	S	M	L	L				M		M				S
CO6	S	M	L	L				M		M				**S**

S- Strong; M-Medium; L-Low

Assessment Pattern: Cognitive Domain

CO	CAT 1			CAT 2			ASSIGNMENT 1				ASSIGNMENT 2				TERMINAL			
TPS SCALE	1	2	3	1	2	3	3	4	5	6	3	4	5	6	1	2	3	4
CO1	8	20													4	10		
CO2	8	10	20					50							4	10	8	
CO3	5	10	20					50							2		8	
CO4				8	10	15					40				4	5	8	
CO5				8	15	10					30				4	5	8	
CO6				4	15	15					30				2	10	8	

Syllabus

Introduction to Signals and Systems:

Classification of Signals and systems- Signal properties: periodicity, absolute integrability, determinism and stochastic character. Test signals: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability. Examples.

Time domain behavior of continuous and discrete time LTI systems

Impulse response and step response, convolution, correlation, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

Laplace and z- Transforms

Laplace Transform for continuous time signals and systems, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

Fourier Transforms

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain,

magnitude and phase response. The Discrete Time Fourier Transform (DTFT), the Discrete Fourier Transform (DFT) its properties. Parseval's Theorem, Fast Fourier Transform (FFT) - radix 2

Reference Book & Web Resources

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and Systems", Pearson India Education Services Pvt. Ltd, 2016.
2. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
3. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, nd Applications", Pearson, Fourth Edition 2006.
4. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.
5. https://nptel.ac.in/courses/117101055/
6. https://www.edx.org/course/signals-and-systems

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Introduction to Signals and Systems**		
1.1	Classification of Signals and systems	2	CO1
1.2	Signal properties: periodicity, absolute integrability, determinism and stochastic character	2	CO1
1.3	Test signals: The unit step, the unit impulse, the sinusoid, the complex exponential signals	1	CO1
1.4	Time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals	1	CO1
1.5	System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability. Examples.	2	CO1
2	**Time domain behaviour of continuous and discrete time LTI systems**		
2.1	Impulse response and step response	1	CO2 &CO3
2.2	Convolution	1	CO2 &CO3
2.3	Input-output behaviour with aperiodic convergent inputs, cascade interconnections.	1	CO2 &CO3
2.4	Characterization of causality and stability of LTI systems.	1	CO2 &CO3
2.5	System representation through differential equations and difference equations	2	CO2 &CO3
2.6	Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.	2	CO4
3	**Laplace and z- Transforms**		
3.1	The Laplace Transform for continuous time signals and systems,	2	CO2
3.2	System functions, poles and zeros of system functions and signals,	2	CO2
3.3	Laplace domain analysis, solution to differential equations and system behaviour	2	CO2
3.4	The z-Transform for discrete time signals and systems	2	CO3

3.5	System functions, poles and zeros of systems and sequences, z-domain analysis	2	CO3
4	**Fourier Transform**		
4.1	Continuous Time Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients	2	CO4
4.2	Discrete Time Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients	2	CO5
4.3	Continuous Time Fourier Transform (CTFT), convolution/multiplication and their effect in the frequency domain, magnitude and phase response	2	CO4
4.4	The Discrete Time Fourier Transform (DTFT) and its properties	2	CO5
4.5	The Discrete FourierTransform (DFT) and its properties ,	2	CO6
4.6	Fast Fourier Transform - radix 2	3	CO6
4.7	Parseval's Theorem	1	CO6
	Total	40	

Course Designers:

Dr.R.Helen Assistant, Professor, EEE rheee@tce.edu
Dr.L.Jessi Sahaya Shanthi,Associate, Professor ,EEE ljseee@tce.edu

22EE350	PROBLEM SOLVING USINGCOMPUTERS

Category	L	T	P	Credit
ESC	3	0	0	3

Preamble

The course on problem solving using computers is intended to introduce the students about the different problem solving strategies with emphasis on python coding. Upon completion of the course, the students would be able to master the principles of interpreted high-level programming and demonstrate significant experience in problem solving.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	TCE Proficienc Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Describe the problem solving strategies and the key terms related to problem solving using computers	TPS2	80	70
CO2	Solve the given problem statement using python programming concepts such as objects, data types, expression , statements, looping.	TPS3	80	70
CO3	Apply the concepts of tuples, list, dictionary and string in design of simple applications	TPS3	80	70
CO4	Make use of functions while developing python scripts.	TPS3	80	70
CO5	Develop coding based on file I/O and exception handling in python.	TPS3	80	70
CO6	Apply the concepts of classes and objects in solving the problem using python programming.	TPS3	80	70

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	L										M	M	M
CO2	S	M	L		M							M	S	S
CO3	S	M	L		M							M	S	S

CO4	S	M	L		M							M	S	S
CO5	S	M	L		M							M	S	S
CO6	S	M	L		M			S	S	S	L	M	S	S

S- Strong; M-Medium; L-Low

Assessment Pattern: Cognitive Domain

CO	CAT 1			CAT 2			ASSIGNMENT 1				ASSIGNMENT 2				TERMINAL			
TPS SCALE	1	2	3	1	2	3	3	4	5	6	3	4	5	6	1	2	3	4
CO1	**5**	10													2	5		
CO2	3	10	30				50									5	15	
CO3	2	10	30				50								2	5	15	
CO4				**5**	10	20					40				2	5	10	
CO5				3	10	20					30				2	5	10	
CO6				2	10	20					30				2	5	10	

Assignment marks are based on python programming

Syllabus

Introduction to Problem Solving: Problem Analysis - Algorithms - Flowcharts, Verifying Algorithms - Comparison of Algorithm - Coding - Problem solving strategies - High level languages, syntax, semantics, compilation and execution, Debugging

Introduction to Python : Introduction - Python Overview - Comments - Python Identifiers - Reserved Keywords -Variables - Standard Data Types - Operators - Statement and Expression - Boolean Expressions - Control Statements - Iteration – while Statement - Input from Keyboard - Basic programming examples

Strings - Lists - Tuples - Dictionaries - Mutability - Development of simple applications

Functions : Introduction - Built-in Functions - Composition of Functions - User Defined Functions - Parameters and Arguments - Function Calls - The return Statement - Python Recursive Function - The Anonymous Functions - Writing Python Scripts

Files and Exceptions: Text Files - Directories - Exceptions - Exception with Arguments -- User-Defined Exceptions

Classes and Objects : Overview of OOP (Object-Oriented Programming) - Class Definition - Creating Objects - Objects as Arguments - Objects as Return Values - Built-in Class Attributes - Inheritance - Method Overriding - Data Encapsulation - Data Hiding

Reference Books

1. John V.Guttag, " Introduction to Computation and Programming Using Python : With Application to Understanding Data", Prentice-Hall International publishers, Second Edition, 2017.
2. E. Bala gurusamy, "Introduction to Computing and Problem Solving using Python", Mcgraw Higher Ed, First Edition, 2016.
3. ReemaThareja, "Python Programming using problem solving Approach", Oxford University, Higher Education Oxford University Press, First edition, 2017.
4. R.G.Dromey, "How to solve it by Computers", Pearson Education India , First Edition, 2008
5. NPTEL course "A joy of computing using python" , https://nptel.ac.in/courses/106106182/
6. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Updated for Python 3, Shroff/O„Reilly Publishers, Second Edition, 2016.
7. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., First Edition, 2016.
8. Mark Pilgrim, "Dive into Python 3", Apress, 2009

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1	**Introduction to Problem Solving**		
1.1	Problem Analysis	**1**	**CO1**
1.2	Algorithms - Flowcharts	**1**	**CO1**
1.3	Verifying Algorithms - Comparison of Algorithm - Coding	**1**	**CO1**
1.4	Problem solving strategies	**2**	**CO1**
1.5	High level languages, syntax, semantics,	**1**	**CO1**

1.6	Compilation and execution, Debugging	1	CO1
2	**Introduction to Python**		
2.1	Introduction - Python Overview	1	CO2
2.2	Comments - Python Identifiers - Reserved Keywords	1	CO2
2.3	Variables - Standard Data Types - Operators	1	CO2
2.4	Statement and Expression	1	CO2
2.5	Boolean Expressions - Control Statements	1	CO2
2.6	Iteration – while Statement - Input from Keyboard	1	CO2
2.7	Basic programming examples	3	CO2
2.8	Strings	1	CO3
2.9	Lists - Tuples	1	CO3
2.10	Dictionaries - Mutability	1	CO3
2.11	Development of simple applications	3	CO3
3	**Functions**		
3.1	Introduction - Built-in Functions - Composition of Functions	1	CO4
3.2	User Defined Functions - Parameters and Arguments	1	CO4
3.3	Function Calls - The return Statement - Python Recursive Function	2	CO4
3.4	The Anonymous Functions - Writing Python Scripts	1	CO4
4	**Files and Exceptions**:		
4.1	Text Files - Directories	1	CO5
4.2	Exceptions - Exception with Arguments	1	CO5
4.3	User-Defined Exceptions	1	CO5
4.4	**Classes and Objects**		

4.5	Overview of OOP (Object-Oriented Programming)	**1**	**CO6**
4.6	Class Definition - Creating Objects	**1**	**CO6**
4.7	Objects as Arguments - Objects as Return Values	**1**	**CO6**
4.8	Built-in Class Attributes - Inheritance	**2**	**CO6**
4.9	Method Overriding - Data Encapsulation - Data Hiding	**1**	**CO6**
Total Lecture Hours		**36**	

Course Designers:

1. Dr.C.K.Babulal,Professor,EEE ckbeee@tce.edu
2. Dr.D.Kavitha,Assistant Professor,EEE dkavitha@tce.edu
3. Dr.S.Charles Raja,Associate Professor,EEE charlesrajas@tce.edu

22EE370	DC MACHINES & TRANSFORMERS LABORATORY

Category	L	T	P	Credit
PCC	-	-	2	1

Preamble

This laboratory gives a practical exposure to the students to learn the characteristics of Transformers and DC Machines that are used nowadays in Electrical Systems. The students also learn to select the suitable DC Electrical Machines for an application based on its characteristics. To familiarize the standard testing procedures of DC Machines and Transformers.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Obtain the characteristics of DC Generator (Shunt, Series & Compound) independently	20
CO2	Obtain the characteristics of DC Motor (Shunt & Series) independently	20
CO3	Determine the Efficiency of DC Machine and calculate the maximum efficiency	10
CO4	Obtain the Voltage Regulation and Efficiency characteristics of Transformer independently	20
CO5	Sketch the Circuit Model of Transformer	20
CO6	Obtain the Thermal & Vibration characteristics of DC Machines and Transformers	10

*** Weightage depends on Bloom's Level, number of contact hours,

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	M	S				S	S				S	
CO2	S	S	M	M	S				S	S				S	
CO3	S	M	L	L	S				S	S				S	
CO4	S	M	L	L	S				S	S				S	

CO5	S	S	M	M	S				S	S				S	
CO6	S	S	M	M	S				S	S				S	

S- Strong; M-Medium; L-Low

Assessment Pattern: Cognitive Domain

Cognitive Levels	Model Examination	Terminal Examination
Remember		
Understand	10	10
Apply	40	40
Analyse	20	20
Evaluate		
Create		

Assessment Pattern: Psychomotor

Psychomotor Skill	Miniproject /Practical Component/Observation
Perception	
Set	
Guided Response	10
Mechanism	20
Complex Overt Responses	
Adaptation	
Origination	

List of Experiments/Activities with CO Mapping

Exp.No	Name	CO
DC Machine		
1	Load characteristics of DC Generators	CO1
2	Methods of Excitation and Voltage Control of DC Generators	CO1
3	Measuring the resistance of Armature and Field Windings	CO1
4	Methods of Starting and Speed Control of DC Motors	CO2
5	Load Characteristics of DC Motors	CO2
6	Swinburne's & Hopkinson's tests	CO3
7	Thermal and Vibration Study of DC Machines	CO6
Transformer		
8	Performance estimation using various load	CO4
9	Performance calculation using equivalent circuit	CO4
10	Measurement of Winding Resistance and Inductance	CO5
11	Sumpner's test / Polarity Test	CO5
12	Thermal and Vibration Study of Transformer	CO6

Reference Books

1. D.P.Kothari & I.J.Nagrath, " Electrical Machines", Tata-McGrawhill, Newdelhi, 5th Edition, 2010.
2. R.K.Rajput, " Electrical Technology", Laxmi Publications, 3rd edition, 2005.
3. Vincent Deldoro ," Electromechanical Energy Conversion " PHI III edition,
4. M.G.Say, Theory and performance of electrical machines, Tata-Mcgraw hill LR2

Course Designers:

1. Dr. V.Saravanan ,Professor,EEE vseee@tce.edu
2. Dr.S.Latha ,Professor,EEE sleee@tce.edu

		Category	L	T	P	Credit
22EE380	**INTEGRATED CIRCUITS LABORATORY**	PCC	-	-	2	1

Preamble

This laboratory gives a practical exposure to the students to learn the characteristics of analog and digital ICs that are used in most of the electronic circuits. Student can also conceive ideas on different electronics circuits have analog and digital ICs and can be able to design and implement it for particular applications.

Prerequisite

22EE260 - Electronics Circuits and devices

22EE280 - Electronics Circuits and devices Lab

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Analyze the performance of the designed circuits like amplifier, filters using operational amplifier for the given applications.	30
CO2	Design the Multivibrator circuits using 555 timers for the given specifications.	5
CO3	Design the voltage regulators using linear Regulator ICs for the given specifications.	5
CO4	Design the Combinational digital circuits for the given requirements using suitable digital ICs.	20
CO5	Design the Digital sequential circuits for the given requirements using suitable digital ICs.	20
CO6	Develop IC based electronic system for a real-world applications	20

*** Weightage depends on Bloom's Level, number of contact hours

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	M	M	S	M		M	M	M				S
CO2	S	S	M	M	S	M		M	M	M				S

CO 3	S	S	M	M	S	M		M	M	M				S
CO 4	S	S	M	M	S	M		M	M	M				S
CO 5	S	S	M	M	S	M		M	M	M				S
CO 6	S	S	M	M	S	M		M	M	M				S

S- Strong; M-Medium; L-Low

Assessment Pattern: Cognitive Domain

Cognitive Levels	Model Examination	Terminal Examination
Remember		
Understand		
Apply	50	50
Analyze	20	20
Evaluate		
Create		

Assessment Pattern: Psychomotor

Psychomotor Skill	~~Miniproject~~ /Practical Component/~~Observation~~
Perception	
Set	
Guided Response	
Mechanism	20
Complex Overt Responses	10
Adaptation	
Origination	

List of Experiments/Activities with CO Mapping

E.No	Name of the experiment	CO	No. of sessions
1.	Characteristics of given Operational Amplifier	CO1	1
2.	Design of Comparator, Amplifier, Integrator, differentiator and Precision rectifiers using OP-AMP	CO1	1

	(Hardware /Simulation)		
3.	Design of Instrumentation Amplifier, Second order active filters using OP AMP/ FPAA (Hardware /Simulation)	CO1	1
4.	Design of V to I , I to V converter, and Oscillator circuits using OP AMP/FPAA (Hardware /Simulation)	CO1	1
5.	Design of Multivibrator circuits using 555 Timer ICs (Hardware /Simulation)	CO2	1
6.	Design of Voltage Regulator for given specification	CO3	1
7.	Realization of Boolean expression using universal gates.	CO4	1
8.	Realization of Full adder, Subtractor, Multiplexer, Demultiplexer, code converters, Decoder and encoder using suitable Digital ICs.(Hardware/ verilog simulation)	CO4	1
9.	Realization of shift Registers and counters using suitable Digital ICs. (Hardware/ verilog simulation)	CO5	1
10	Development of IC based electronic system for a real-world applications (selected by group of students)	CO6	2

Reference Books

1. Roy Choudhury and shall B.Jain, Linear Integrated circuits, Wiley Eastern Ltd, 5th edition, 2018
2. Jacob Millman & Christos C.Halkias- Integrated electronics, McGraw Hill Education; 2 edition ,2017
3. M.Morris Mano and Michael D.Ciletti, Digital Design, Sixth Edition, Pearson Prentice Hall, 2018

Course Designers:

1. Dr.R.Helen , Assistant Professor,EEE rheee@tce.edu
2. Dr.D.Kavitha , Assistant Professor,EEE dkavitha@tce.edu
3. Dr.B.Ashok Kumar, Assistant Professor,EEE ashokudt@tce.edu