Course Title	Applied Mathematics III for Electrical and Electronics Stream (ECE & EEE)	**Semester**	3
Course Code	ML201	**CIE**	50
Total No. of Contact Hours	50	**SEE**	50
No. of Contact Hours/week	3:2:0	**Total**	100
Credits	4	**Exam. Duration**	3 Hours
Teaching Dept.	Mathematics		

Course objective is to:

- Use Fourier series to represent periodical physical phenomena in engineering analysis and to enable the student to express non periodic functions to periodic function using Fourier series.
- Analyze signals in terms of Fourier transforms
- Acquaint the students with differential equations and their applications in electrical and electronics engineering.
- Analyze engineering problems by applying Partial Differential Equations.

Find the association between attributes and the correlation between two variables.

Module-1	**RBT Level L1, L2, L3**	**10 Hours**

Fourier Series:

Introduction to infinite series, convergence and divergence. Periodic functions, Dirichlet's condition. Fourier series of periodic functions with period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis.

Signals: Continuous-Time and Discrete-Time Signals, Transformations of the Independent Variable, Exponential and Sinusoidal Signals, The Unit Impulse and Unit Step Functions.

Module-2	**RBT Level L1, L2,L3**	**10 Hours**

Fourier Transform:

Introduction to Infinite Fourier transforms, definition, Fourier sine and cosine transforms. Inverse Fourier transforms, Inverse Fourier cosine and sine transforms. Discrete Fourier transform (DFT), Fast Fourier transform (FFT).

Module-3	**RBT Level L1, L2,L3**	**10 Hours**

Higher Order Ordinary Differential Equations:

Higher -order linear ordinary differential equations with constant coefficients - Inverse differential operator, method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. Solution of ODE using MATLAB

Module-4	**RBT Level L1, L2,L3**	**10 Hours**

Partial Differential Equations:

Formation of PDE's by elimination of arbitrary constants and functions. Solution of nonhomogeneous PDE by direct integration. Homogeneous PDEs involving derivatives with respect to one independent variable only. Solution of Lagrange's linear PDE. Derivation of one-dimensional heat equation and wave equation. Solution of PDE using MATLAB.

Module-5	RBT Level L1, L2,L3	10 Hours

Statistical method:

Correlation and Regression-Karl Pearson's coefficient of correlation and rank correlation. Regression analysis- lines of regression. Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form- $y = ax + b$, $y = ax^b$ $an\, y = ax^2 + bx + c$. Lines of regression and curve fitting using MATLAB.

Suggested Learning Resources:

Textbooks:

1.	B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2.	Erwin Kreyszig –Advanced Engineering Mathematics, Wiley publication, 10th edition, 2015.
3.	Alan V. Oppenheim & Alan S. Willsky, Signals & Systems, Prentice Hall, Latest Edition

Reference Books:

1.	Srimanta Pal & Subodh C Bhunia -Engineering Mathematics, Oxford University Press, 3rd Reprint, 2016.
2.	B. V. Ramana - Higher Engineering Mathematics, Tata McGraw-Hill, 11th edition, 2010.
3.	N.P.Bali and Manish Goyal:"A textbook of Engineering Mathematics", Laxmi publications,10th edition ,2022.

Web links and Video Lectures (e-Resources):

1. **https://youtu.be/HoGNkZclxDU?si=3Q-8nEthEPGVwbPs**
2. **https://youtu.be/lkAvgVUvYvY?si=yKBK7PPLHq5rYhPQ**
3. **https://youtu.be/IwVIDnyBRm8?si=KayxT9JM7VgFIuom**
4. **https://youtu.be/U51lQtlzvA0?si=jgt6xYsnLiVzEk66**
5. **https://youtu.be/1iJGLcP__s0?si=ZMpHoqCUbH5V8FXT**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

1. **Quiz**
2. **Assignment**
3. **Group Discussions**

Course Outcomes: At the end of the course students will be able to	
CO1	Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing and field theory.
CO2	Use Fourier transforms to analyze problems involving continuous-time signals
CO3	Understand that physical systems described by differential equations and solve such equations.
CO4	Demonstrate partial differential equations and their solutions for physical interpretations.
CO5	Make use of correlation and regression analysis to fit a suitable mathematical model for statistical data.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	2	-	-	-	-	-	-	-	2
CO2	2	2	-	2	-	-	-	-	-	-	-	2
CO3	2	2	-	2	-	-	-	-	-	-	-	2
CO4	2	2	-	2	-	-	-	-	-	-	-	2
CO5	2	2	-	2	-	-	-	-	-	-	-	2

High-3, Medium-2, Low-1

Course Title	Transformers and D.C. Machines	**Semester**	3
Course Code	EE202	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	3:0:0	**Total**	100
Credits	03	**Exam. Duration**	3 Hours
Teaching Dept.	Electrical and Electronics Engineering		

Course Objective is:

- To understand the concepts of transformers and their analysis.
- To explain the requirement for the parallel operation of transformers and autotransformers.
- To study the constructional features of D.C. machines and select a suitable drive for specific application.
- To study the speed control of D.C. motor by different methods.
- To study different test to be conducted for the assessment of the performance characteristics of D.C motors.

Module-1	**RBT Levels: L1, L2, L3**	**Hours: 08**

Single phase Transformers:
Necessity of transformer, principle of operation, types and construction, EMF equation, equivalent circuit, operation of practical transformer under no-load and on-load with phasor diagrams, losses and methods of reducing losses, efficiency and condition for maximum efficiency, all day efficiency, numericals.

Module-2	**RBT Levels: L2, L3**	**Hours: 08**

Tests on Transformers: Polarity test, Sumpner's test, open circuit and short circuit tests, calculation of equivalent circuit parameters, predetermination of efficiency, voltage regulation and its significance, numericals.

Three-phase Transformers: Introduction, constructional features of three-phase transformers, transformer connection for three phase operation and vector diagram – star/star, delta/delta and star/delta, comparative features, labelling of three-phase transformer terminals.

Module-3	**RBT Levels: L2, L3**	**Hours: 08**

Parallel Operation of Transformers: Necessity of parallel operation, conditions for parallel operation – single phase and three phase, load sharing in case of similar and dissimilar transformers, numericals.
Auto Transformers and Tap Changing Transformers: Introduction to autotransformer – copper economy, equivalent circuit, no load and on load tap changing transformers, numericals.

Module-4	**RBT Levels: L1, L2, L3**	**Hours: 08**

DC Machines: Construction, principle of operation of D.C. generator, emf equation.

DC Motors: Working principle**,** back emf and its significance, torque equation, classification, characteristics of shunt, series and compound motors, speed control of shunt, series and compound motors, application of motors, D.C. motor starters – 3 point and 4 point, numericals.

Losses and Efficiency- Losses in D.C. motors, power flow diagram, efficiency, condition for maximum efficiency, numericals.

Module-5	**RBT Levels: L1, L2, L3**	**Hours: 08**

Testing of DC Motors: Direct and indirect methods of testing of D.C. motors - brake test, Swinburne's test, retardation test, Hopkinson's test, field's test, merits and demerits of tests, numericals.
Special Machines: Construction and working principle of BLDC, stepper motor, universal motor and their applications.

Suggested Learning Resources:	
Textbooks:	
1	B.L Theraja, "A Text book of Electrical Technology", Volume I, S Chand, 1st Revised Edition, 2020.
2	B.L.Theraja, "A Text book of Electrical Technology",Volume II, S Chand, 23rd Edition 2022.
Reference Books:	
1	S. Sarma, "Electric Machines, Mulukuntla" at el, Cengage, 1st Edition, 2009.
2	Theodore Wildi, "Electrical Machines, Drives and Power Systems", Pearson, 6th Edition, 2013.
3	V.K Mehta, Rohit Mehta, "Principals of Electrical Machines", S Chand, 2nd Edition, 2002
4	D. P. Kothari, I. J. Nagrath, "Electric Machines", McGraw Hill, 4th Edition, 2011
5	Alexander Langsdorf, "Theory of Alternating Current Machines", McGraw Hill, 2nd Edition, 2001.
6	Ashfaq Hussain, "Electric Machines", Dhanpat Rai & Co, 2nd Edition, 2013.
Web links and Video Lectures (e-Resources): **NPTEL: https://archive.nptel.ac.in/courses/108/105/108105155**	
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning Peer learning Course seminar	

Course Outcomes: At the end of the course the student will be able to	
CO1	Explain the construction and operation of single phase, three phase transformers, and autotransformer.
CO2	Analyze the performance of transformers by polarity test, Sumpner's test, three phase connection and parallel operation.
CO3	Explain the construction and working of D.C. machines and the classification of D.C. motors.
CO4	Describe the performance characteristics and applications of electric motors.
CO5	Explain the methods of testing of D.C. machines and determine losses and efficiency.

CO-PO Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	-	-	2	2	-	-	-	-	2	2	2	-
CO2	2	2	-	-	-	2	2	-	-	-	-	2	2	2	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	2	2	-
CO4	2	2	-	-	-	2	2	-	-	-	-	2	2	2	-
CO5	2	2	-	-	-	2	2	-	-	-	-	2	2	2	-

High-3, Medium-2, Low-1

Transformers and D.C. Machines Laboratory			
Course Code	EE203	**CIE Marks**	50
L:T:P	0:0:2	**SEE Marks**	50
Hrs. / Week	2	**Total Marks**	100
Credits	01	**Exam Hours**	03

Course Objectives: At the end of the course, the student will be able:	
1	To conduct various tests on transformers and synchronous machines and evaluate their performance.
2	To perform the parallel operation on two single phase transformers.
3	To perform tests on D.C. machines to determine their characteristics.
4	To control the speed of D.C. motor.
5	To conduct test for predetermination of the performance characteristics of D.C. machines.

Exp. No.	List of Experiments	Hours	COs
	Prerequisite Experiments / Demo		
	Demonstration of transformers and D.C. machines	2	1,3
	PART-A		
1	Open circuit and short circuit tests on single phase transformer and predetermination of (i) Efficiency and regulation (ii) Calculation of parameters for equivalent circuit.	2	1
2	Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.	2	1
3	Parallel operation of two dissimilar single phase transformers of different kVA and determination of load.	2	2
4	Polarity test and connection of 3 single-phase transformers in star- delta and determination of efficiency and regulation under balanced resistive load.	2	1
5	Speed control of D.C. motors by armature voltage control and field control method.	2	3
6	Swinburne's test on D.C. motor.	2	4
7	Field test on D.C. series machines.	2	4
8	Retardation test on D.C. shunt motor.	2	4
9	Regenerative test on D.C. shunt machines.	2	4
10	Load test on D.C. shunt motor to draw speed–torque and horse power–efficiency characteristics.	2	3
	PART-B		

Beyond Syllabus

1. Investigate the voltage and current ratios of multi tapped transformer and verify the ideal transformer ratio.
2. Virtual Lab Content**:** Any three experiments can be carried out using Scilab.

Suggested Learning Resources:
Textbooks:

1	B.L.Theraja, "A Text book of Electrical Technology", Volume I, S Chand, 1st Revised Edition, 2020.

2	B.L.Theraja, "A Text book of Electrical Technology",Volume II, S Chand, 23rd Edition 2022.
Reference Books:	
1	Mulukuntla S. Sarma, "Electric Machines" at el, Cengage, 1st Edition, 2009.
2	Theodore Wildi, "Electrical Machines, Drives and Power Systems", Pearson, 6th Edition, 2013.
3	V.K Mehta, Rohit Mehta, "Principals of Electrical Machines", S Chand, 2nd Edition, 2002
4	D. P. Kothari, I. J. Nagrath, "Electric Machines", McGraw Hill, 4th Edition, 2011
Web links and Video Lectures (e-Resources): https://youtube.com/playlist?list=PLf8yqwn893IjoQXvJmyzg1MJZmJTFDwhx&feature=shared	
Activity-Based Learning (Suggested Activities in Class)/Practical-Based learning Any three experiments can be done using open source software.	

Course Outcomes: At the end of the course the student will be able to:	
CO1	Conduct various tests on transformers and evaluate their performance.
CO2	Perform the parallel operation on two single phase transformers.
CO3	Test D.C. motors to determine their characteristics and also to control the speed of D.C. motor.
CO4	Predetermine the performance characteristics of D.C. motors by conducting suitable tests.

CO-PO Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	-	-	2	2	-	2	-	-	2	2	2	-
CO2	2	2	-	-	-	2	2	-	2	-	-	2	2	2	-
CO3	2	2	-	-	-	2	2	-	2	-	-	2	2	2	-
CO4	2	2	-	-	-	2	2	-	2	-	-	2	2	2	-

High-3, Medium-2, Low-1

Course Title	Analog and Digital Electronic Circuits	**Semester**	3
Course Code	EE204	**CIE**	50
Total No. of Contact Hours	50	**SEE**	50
No. of Contact Hours/week	3:2:0	**Total**	100
Credits	04	**Exam. Duration**	3 Hours
Teaching Dept.	Electrical and Electronics Engineering		

Course Objective is:

- To provide the knowledge for diode applications in electronic circuits.
- To provide the knowledge for the analysis of transistor biasing and thermal stability circuits.
- To develop skills to design the electronic circuits like amplifiers, power amplifiers and oscillators.
- To understand the importance of FET and MOSFET.
- To provide the knowledge for the analysis and design of combinational logic, sequential logic, programmable logic circuits.

Module-1	**RBT Levels: L1, L2, L3**	**Hours: 10**

Diode Circuits: Diode clipping and clamping circuits.
Transistor Biasing and Stabilization: The operating point, load line analysis, D.C. analysis and design of fixed bias circuit, emitter stabilized bias circuit, collector to base bias circuit, voltage divider bias circuit, bias stabilization and stability factors for fixed bias circuit, transistor as a switch.

Module-2	**RBT Levels: L1, L2, L3**	**Hours: 10**

Transistors Amplifier: Small signal BJT amplifiers, A.C. equivalent circuit, CE amplifier analysis using hybrid model, multistage amplifiers, power amplifiers, class A, B, AB, C and D stages.
Feedback and Oscillator Circuits: Effect of positive and negative feedback, basic feedback topologies and their properties, sinusoidal oscillators (RC, LC and Crystal).

Module-3	**RBT Levels: L1, L2**	**Hours: 10**

FETs and MOSFETs: Construction, working and characteristics of JFET and MOSFET (enhance and depletion type) biasing of JFET and MOSFET, fixed bias configuration, self-bias configuration, voltage divider biasing. Analysis and design of JFET (only common source configuration with fixed bias) and MOSFET amplifiers.

Module-4	**RBT Levels: L1, L2, L3**	**Hours: 10**

Combinational Logic: Karnaugh maps, two, three and four variable karnaugh maps, simplification of expressions, Quine-McCluskey minimization technique.
Analysis and Design of Combinational Logic: Introduction to combinational circuits, code conversions, decoder, encoder, binary adder, subtractor.

Module-5	**RBT Levels: L2, L3**	**Hours: 10**

Sequential Logic: Sequential circuits, flip-flops, clocked and edge triggered flipflops, timing specifications, asynchronous and synchronous counters, counter design with state equations, registers, serial in serial out shift registers.
Sequential Circuits: Mealy and Moore model - State diagrams and tables, transition table, excitation table and equations.

Suggested Learning Resources: **Textbooks:**	
1	Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Robert L. 10th Edition, 2009.
2	William Kleitz, "Digital Electronics", Prentice Hall International Inc. 9th Edition, 2021.
Reference Books:	
1	M. S. Tyagi, "Introduction to Semiconductor Materials and Devices", John Wiley and Sons Inc. 1st Edition, 2008
2	A.P. Malvino, "Electronic Principles", Tata Mcgraw Hill Publications, 7th Edition, 2007.
3	Jacob Millman, and C.C. Halkias, "Electronic Devices and Circuits", TMH Publications, 4th Edition, 2017.
Web links and Video Lectures (e-Resources): https://youtu.be/oNh6V91zdPY	
Activity-Based Learning (Suggested Activities in Class) / Practical-Based learning 1) Quiz 2) Peer-to-peer learning 3) Seminar	

Course Outcomes: At the end of the course, the student will be able to	
CO1	Utilize the characteristics of transistor for different applications.
CO2	Design and analyze biasing circuits for transistor.
CO3	Design, analyze and test transistor circuitry as amplifiers and oscillators and the working principles and applications of FET and MOSFET.
CO4	Design and analyze combinational logic circuits.
CO5	Design and analyze sequential logic and programmable logic circuits.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-

High-3, Medium-2, Low-1

Analog and Digital Electronics Laboratory			
Course Code	EE205	**CIE Marks**	50
L:T:P	0:0:2	**SEE Marks**	50
Hrs. / Week	2	**Total Marks**	100
Credits	01	**Exam Hours**	03

Course Objectives: At the end of the course, the student will be able:	
1	To design and test half wave, full wave rectifier circuits, clipper and clamper circuits.
2	To design and test different amplifier and oscillator circuits using BJT/FET.
3	To study the simplification of boolean expressions using logic gates.
4	To realize different adders and subtractors circuits.
5	To design and test counters and sequence generators.

Exp. No.	List of Experiments	Hours	COs
	Prerequisite Experiments / Demo		
	Demo on working of CRO, signal generator, multi-meter and digital kit.	2	
	PART-A		
1	Design and testing of full wave – center tapped transformer type and bridge type rectifier circuits with and without capacitor filter, determination of ripple factor, regulation and efficiency.	2	1
2	Testing of diode clipping and clamping circuits.	2	1
3	Frequency response of single stage BJT/FET RC coupled amplifier and determination of half power points, bandwidth, input and output impedances.	2	2
4	Design and testing of BJT - RC phase shift and crystal oscillator for given frequency of oscillation.	2	2
5	Testing of a transformer less Class - B push pull power amplifier and determination of its conversion efficiency.	2	2
6	Simplification, realization of boolean expressions using logic gates / universal gates.	2	3
	PART-B		
7	Realization of half/Full adder and subtractor using logic gates.	2	4
8	Realization of parallel adder/sub tractors using 7483 chip- BCD to Excess-3 code conversion and vice versa, binary to gray code conversion and vice versa.	2	4
9	Design and testing ring counter/Johnson counter.	2	5
10	Design and testing of sequence generator.	2	5
11	Realization of 3-bit counters as a sequential circuit and MOD – N counter design using 7490, 74192, 74193.	2	5
	PART-C		
	Beyond Syllabus Virtual Lab Content A minimum of three experiments to be simulated using (Freeware Software Package)		

Suggested Learning Resources: **Textbooks/ Reference Books:**	
1	Robert L, "Electronic Devices and Circuit Theory", Boylestad and Louis Nashelsky, 10th Edition, 2009.
2	William Kleitz, "Digital Electronics", Prentice Hall International Inc. 9th Edition, © 2012.
3	Geeta Bhatt and Geeta Mongia "Experiments based on analog and digital electronics", TechSar Pvt Ltd, 2012.
Web links and Video Lectures (e-Resources): https://www.youtube.com/playlist?list=PLE1mWp6tTcKMhpy-7JFUk-WBH8RdjwAkf	
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning Design voltage regulator circuit	

Course Outcomes: At the end of the course, the student will be able to	
CO1	Design and test rectifier circuits, clipper and clamper circuits.
CO2	Design and test BJT, FET, power amplifier and oscillator circuits.
CO3	Realize boolean expressions, adders and subtractors using gates.
CO4	Design and test ring counter/Johnson counter, sequence generator and 3 bit counters.

CO-PO Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	2	2	-	-	-	2	-
CO2	3	2	-	-	-	-	-	-	2	2	-	-	-	2	-
CO3	3	2	-	-	-	-	-	-	2	2	-	-	-	2	-
CO4	3	2	-	-	-	-	-	-	2	2	-	-	-	2	-

High-3, Medium-2, Low-1

Course Title	Electric Circuit Analysis	**Semester**	3
Course Code	EE206	**CIE**	50
Total No. of Contact Hours	45	**SEE**	50
No. of Contact Hours/week	2:0:2	**Total**	100
Credits	03	**Exam. Duration**	3 Hours
Teaching Dept.	Electrical and Electronics Engineering		

Course Objective is:

- To familiarize the basic laws, source transformations, and the methods of analyzing electrical circuits.
- To explain the use of network theorems and the concept of resonance.
- To familiarize the analysis of three-phase circuits, two port networks and networks with non-sinusoidal inputs.
- To explain the importance of initial conditions, their evaluation and transient analysis of RL and RC circuits.
- To impart basic knowledge on network analysis using laplace transforms.

Module-1:	**RBT Levels: L1, L2, L3**	**Hours: 09**

Basic Concepts: Active and passive elements, concept of ideal and practical sources, star–delta transformation, analysis of networks by (i) Network reduction method (ii) Mesh and Node voltage methods for A.C. and D.C. circuits with independent and dependent sources, concept of super-mesh and super node analysis, duality.

Module-2:	**RBT Levels: L1, L2, L3**	**Hours: 09**

Network Theorems: Super position theorem, reciprocity theorem, thevenin's theorem, norton's theorem, maximum power transfer theorem, millman's theorem, analysis of networks (only with independent A.C. and D.C. sources).

Module-3:	**RBT Levels: L1, L2, L3**	**Hours: 09**

Resonant Circuit: Basic concept of resonance, analysis of simple series RLC and parallel RLC circuits under resonance, problems on resonant frequency, bandwidth and quality factor at resonance.

Transient Analysis: Behaviour of circuit elements under switching action, evaluation of initial and final conditions, transient analysis of RL and RC circuits under D.C. excitations.

Module-4:	**RBT Levels: L2, L3**	**Hours: 09**

Laplace Transformation: Laplace transformation definition, LT of impulse, step, ramp, sinusoidal signals and shifted functions, periodic functions, waveform synthesis. initial and final value theorems.

Module-5:	**RBT Levels: L2, L3**	**Hours: 09**

Unbalanced Three Phase Circuits: Analysis of three phase systems, calculation of real and reactive powers and analysis as applicable to star / delta connected load.

Two Port Networks: Definition, open circuit impedance, short circuit admittance, and transmission parameters and their evaluation for simple circuits.

Open ended experiments leading to guided projects:

Practice Experiments (Hardware/Simulation):

1. Study of the effect of Open and Short circuits in simple circuits.
2. Verification of Thevenin's theorem.
3. Verification of Norton's theorem.
4. Verification of superposition theorem.
5. Verification of maximum power transfer theorem.
6. Verification of reciprocity Theorem.
7. Determination of resonant frequency, bandwidth, and Q of a series circuit.
8. Determination of resonant frequency, bandwidth, and Q of a parallel circuit.
9. Measurement of time constant of an RC circuit.
10. Measurement of power in three phase Circuits using two wattmeter method.

Suggested Learning Resources:

Textbooks:

1	William H Hayt et al, "Engineering Circuit Analysis", Mc Graw Hill, 8th Edition, 2014.

Reference Books:

1	M.E. Van Valkenburg, "Network Analysis", Pearson, 3rd Edition, 2014.
2	Charles K Alexander Matthew N O Sadiku, "Fundamentals of Electric Circuits", McGraw Hill, 5th Edition, 2013.

Web links and Video Lectures (e-Resources):

NPTEL: https://archive.nptel.ac.in/courses/108/105/108105159/

Activity-Based Learning (Suggested Activities in Class)/Practical-Based learning

1) Quiz
2) Peer-to-peer learning
3) Seminar
4) Simulation based on theorem

Course Outcomes: At the end of the course, the student will be able to	
CO1	Explain the basic concepts, basic laws, methods of analysis and reduction techniques of D.C. and A.C. networks.
CO2	Solve complex electric circuits using network theorems.
CO3	Discuss resonance in series and parallel circuits and also the importance of initial conditions and their evaluation
CO4	Synthesize typical waveforms using laplace transformation
CO5	Solve unbalanced three phase systems and also evaluate the performance of two port networks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	-	-	1	-	-	-	-	-	-	-	3	1	-
CO2	3	3	-	-	1	-	-	-	-	-	-	-	3	1	-
CO3	3	3	-	-	1	-	-	-	-	-	-	-	3	1	-
CO4	3	3	-	-	1	-	-	-	-	-	-	-	3	1	-
CO5	3	3	-	-	1	-	-	-	-	-	-	-	3	1	-

High-3, Medium-2, Low-1

Course Title	Physics Of Electronic Devices	**Semester**	3
Course Code	EE221	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	3:0:0	**Total**	100
Credits	3	**Exam. Duration**	3 Hours
Teaching Dept	Electrical and Electronics Engineering		

Course Objectives:

This course will enable students to

- Understand the basics of semiconductor physics and electronic devices
- Describe the mathematical models BGTs and FETs along with the constructional details
- Understand the construction and working principles of optoelectronic devices
- Understand the fabrication process of semiconductor devices and CMOS process integration

Module-1	**RBT Levels: L1, L2**	**Hours: 08**

Semiconductors

Bonding forces in solids, energy bands, metals, semiconductors and insulators, direct and indirect semiconductors, electrons and holes, intrinsic and extrinsic materials, conductivity and mobility, drift and resistance, effects of temperature and doping on mobility, Hall effect

Module-2	**RBT Levels: L1, L2**	**Hours: 08**

P-N JUNCTIONS:

Forward and reverse bias junctions, Qualitative description of current flow at a junction, reverse bias and reverse bias breakdown, Zener breakdown, avalanche breakdown, Thermal runaway.

Optoelectronic Devices:

Photo diodes, current and voltage in illuminated junction, solar cells, photo detectors, lightemitting diode, light emitting materials

Module-3	**RBT Levels: L1, L2**	**Hours: 08**

Bipolar Junction Transistor:

Fundamentals of BJT operation, amplification with BJTs, BJT fabrication, the Coupled diode model (Ebers –Moll Model), switching operation of transistor, cutoff, saturation, switching cycle, specifications, drift in the base region, base narrowing, avalanche breakdown.

Module-4	**RBT Levels: L1, L2**	**Hours: 08**

Field Effect Transistors:

Basic PN JFET operation, equivalent circuit and frequency limitation, MOSFET two terminal MOS structure, energy band diagram, ideal capacitance voltage characteristics and frequency effects, basic MOSFET operation, MOSFET structure, current-voltage characteristics

Module-5	**RBT Levels: L1, L2**	**Hours: 08**

Fabrication of PN junction:

Thermal oxidation, diffusion, rapid thermal processing, Ion implantation, chemical vapour deposition, photolithography, etching, metallization

Integrated Circuits:

Background, evolution of ICs, CMOS process integration, integration of other circuit elements

.

Suggested Learning Resources:	
Textbooks:	
1	Ben. G. Streetman, Sanjay Kumar Banerjee, "Solid State Electronic Devices", 7th Edition, PearsonEducation 2016
2	Donald A Neamen, Dhrubes Biswas, "Semiconductor physics and Devices", 4th Edition, MC GrawHill Education 2012
Reference Books:	
1	S.M. Sze, Kwok K Ng, "Physics of semiconductor devices", 3rd edition, Wiley 2018
2	Adir Bar-Lev, "Semiconductor and electronic devices", 3rd Edition , PHI, 1993.

Web links and Video Lectures (e-Resources):

- NPTEL lecturers on semiconductor physics: https://archive.nptel.ac.in/courses/108/108/108108122/
- Undergraduate course on semiconductor physics ;https://www.udemy.com/course/semiconductor-device-physics-an-introduction/
- You tube videos on semiconductor physics

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Applications of optoelectronics devices
- Applications and basics of microelectronic fabrication

Course Outcomes: At the end of the course the student will be able to**:**	
CO1	Understand the principles of semiconductor physics
CO2	Understand the principles and characteristics of different types of semiconductor devices
CO3	Understand the fabrication process of semiconductor devices
CO4	Utilize the mathematical models of MOS transistors for circuits and systems
CO5	Identify the mathematical models of MOS transistors for circuits and systems

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	3	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	3	2	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	3	2	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	3	2	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	3	2	-

High-3, Medium-2, Low-1

Course Title	Electrical and Electronics Measurement and Instrumentation	**Semester**	3
Course Code	EE222	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	3:0:0	**Total**	100
Credits	03	**Exam. Duration**	3 Hours
Teaching Dept.	Electrical and Electronics Engineering		

Course Objective is to:

- Understand the concept of unit and dimensions.
- Analyze the circuits for the measurement of resistance, capacitance, inductance, and frequency.
- Understand and analyze adjustments, calibration and errors in energy meters
- Analyze the constructions and working of various meters used for measurements.
- Recognize and analyze significance and working of different types of transducers.

Module-1	**RBT Levels: L1,L2**	**Hours: 08**

Units and Measurements: Review of fundamental and derived units. SI units. Dimensional equations in CGS, MKS and SI units.
Measurements of Resistance: Wheatstone bridge, bridge sensitivity, kelvin's double bridge, problems solved. Earth resistance measurement by fall of potential method and by using megger.
Measurement of Inductance and Capacitance: Sources and detectors, Maxwell's inductance and capacitance bridge, De-Sauty's bridge, shielding of bridges.

Module-2	**RBT Level: L2, L3**	**Hours: 08**

Measurement of Power, Energy, Power Factor and Frequency: Review of dynamometer wattmeter construction and operation. Torque expression, errors and minimization, LPF wattmeter, construction and operation of 1-ϕ and 3- ϕ dynamometer type power factor meter, weston frequency meter, phase sequence indicator.

Module-3	**RBT Level: L2, L3**	**Hours: 08**

Extension of Instrument Ranges: Desirable features of ammeters and voltmeters, shunts and multipliers, construction and theory of instrument transformer, desirable characteristics, errors of CT's and PT's, turns compensation, illustrative examples, Silsbee's method of testing CT.

Module-4	**RBT Level: L1, L2, L3**	**Hours: 08**

Electronics and Digital Instrumentation: Introduction, essential of electronic instruments, advantages of electronics instruments, advantages of electronics instruments, true rms reading of voltmeter, electronics multimeters: Digital voltmeter (DVM), ramp type DVM, integrating DVM, Q-meter, principal of working of electronic energy meter.

Module-5	**RBT Level: L1, L2, L3**	**Hours: 08**

Transducers: Introduction, electrical transducers, selecting a transducer, resistive transducer, resistive position transducer, strain gauges, resistance thermometer, thermistor, inductive transducer, LVDT, piezoelectric transducer, photocell, photo voltaic cell, semiconductor photo diode and transistor.

Suggested Learning Resources: **Textbooks:**	
1	A.K Sawhney, "Electrical and Electronic measurements", Dhanpat Rai and Co, 10th Edition, 2013.
2	J.B Gupta, "A course in Electrical and Electronics Measurements and Instrumentation", S K Kataria and Sons, Reprint Edition 2013.
3	H.S Kalsi, "Electronic Instrumentation", McGraw Hill, 3rd Edition, 2012.
Reference Books:	
1	R. K Rajput, "Electrical and Electronics Measurement", S chand 5th Edition, 2012.
2	S.C Bhargava, "Electrical measurements Instruments", BS publication, 2013.
3	Cooper D and A.D Heifrick, "Modern Electronic Instrumentation and measuring techniques", Pearson, First Edition, 2015.
4	David. A. Bell, "Electronic Instrumentation and Measurements", McGraw Hill, 3rd Edition, 2010.
Web links and Video Lectures (e-Resources): **https://www.youtube.com/watch?v=3eYmFjHnQjY&list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio**	
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning Seminar, Quiz, Peer to Peer learning, mini project based on above module.	

Course outcomes: At the end of the course the student will be able to**:**	
CO1	Explain the importance of units and dimensions.
CO2	Measure resistance, inductance and capacitance by various methods.
CO3	Explain the working of various meters used for measurements of power and energy.
CO4	Explain the working of different electronic measuring instruments.
CO5	Analyze and understand the working of different types of transducers.

CO-PO Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	1	-
CO3	3	3	-	-	-		-	-	-	-	-	-	3	2	-
CO4	3	1	-	-	-		-	-	-	-	-	-	3	2	-
CO5	3	2	3	-	-	-		-	-	-	-	-	3	2	-

High-3, Medium-2, Low-1

Course Title	Basic VLSI Design	**Semester**	3
Course Code	EE223	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	3:0:0	**Total**	100
Credits	03	**Exam. Duration**	3 Hours
Teaching Dept.	Electrical and Electronics Engineering		

Course objectives:

- Impart knowledge of MOS transistor theory and CMOS technologies
- Impart knowledge on architectural choices and performance trade-offs involved in designing and realizing the circuits in CMOS technology
- Cultivate the concepts of subsystem design processes
- Demonstrate the concepts of CMOS testing

Module-1	**RBT Levels: L1,L2**	**Hours: 08**
Introduction: A Brief History, MOS Transistors, MOS Transistor Theory, Ideal I-V Characteristics, Nonideal I-V Effects, DC Transfer Characteristics. **Fabrication**: nMOS Fabrication, CMOS Fabrication [P-well process, N-well process, Twin tub process], BiCMOS Technology		
Module-2	**RBT Level: L2, L3**	**Hours: 08**
MOS and BiCMOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout. Basic Circuit Concepts: Sheet Resistance, Area Capacitances of Layers, Standard Unit of Capacitance, Some Area Capacitance Calculations, Delay Unit, Inverter Delays, Driving Large Capacitive Loads		
Module-3	**RBT Level: L2, L3**	**Hours: 08**
Scaling of MOS Circuits: Scaling Models & Scaling Factors for Device Parameters Subsystem Design **Processes:** Some General considerations, An illustration of Design Processes, Illustration of the Design **Processes:** Regularity, Design of an ALU Subsystem, The Manchester Carrychain and Adder Enhancement Techniques		
Module-4	**RBT Level: L1, L2, L3**	**Hours: 08**
Subsystem Design: Some Architectural Issues, Switch Logic, Gate (restoring) Logic, Parity Generators, Multiplexers, The Programmable Logic Array (PLA) **FPGA Based Systems:** Introduction, Basic concepts, Digital design and FPGAs, FPGA based System design, FPGA architecture, Physical design for FPGAs		
Module-5	**RBT Level: L1, L2, L3**	**Hours: 08**
Memory, Registers and Aspects of system Timing: System Timing Considerations, Some commonly used Storage/Memory elements. **Testing and Verification:** Introduction, Logic Verification, Logic Verification Principles, Manufacturing Test Principles, Design for testability		

Suggested Learning Resources:

Textbooks:

1	"Basic VLSI Design"- Douglas A Pucknell & Kamran Eshraghian, PHI, 3rd Edition
2	"CMOS VLSI Design- A Circuits and Systems Perspective", Neil H E Weste, David Harris, Ayan Banerjee, 3rd Edition, Pearson Education.
3	"FPGA Based System Design", Wayne Wolf, Pearson Education, 2004, Technology and Engineering

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/117101058
- https://nptel.ac.in/courses/117106093
- https://youtu.be/9SnR3M3CIm4
- https://nptel.ac.in/courses/108/107/108107129/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

Wherever necessary Cadence/Synopsis/Menta Graphics tools must be used.

1.Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library with given Constraints*. Do the initial timing verification with gate level simulation.

i. An inverter
ii. A Buffer
iii. Transmission Gate
iv. Basic/universal gates
v. Flip flop -RS, D, JK, MS, T
vi. Serial & Parallel adder
vii. 4-bit counter [Synchronous and Asynchronous counter]

2. Design an op-amp with given specification* using given differential amplifier Common source and Common Drain amplifier in library** and completing the design flow mentioned below:

a. Draw the schematic and verify the following
   i) DC Analysis
   ii) AC Analysis
   iii) Transient Analysis
b. Draw the Layout and verify the DRC, ERC
c. Check for LVS
d. Extract RC and back annotate the same and verify the Design.

Course Outcomes: At the end of the course, the student will be able to	
CO1	Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling
CO2	Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.
CO3	Interpret Memory elements along with timing considerations
CO4	Demonstrate knowledge of FPGA based system design
CO5	Interpret testing and testability issues in VLSI Design
CO6	Analyze CMOS subsystems and architectural issues with the design constraints.

CO-PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	-	-	-	-	-	-	-	2	-	-	2	2	-
CO2	3	3	-	-	-	-	-	-	-	2	-	-	2	2	-
CO3	3	3	-	-	-	-	-	-	-	2	-	-	2	2	-
CO4	3	3	-	-	-	-	-	-	-	2	-	-	2	2	-
CO5	3	3	-	-	-	-	-	-	-	2	-	-	2	2	-
CO6	3	3	-	-	-	-	-	-	-	2	-	-	2	2	-

High-3, Medium-2, Low-1

Course Title	PCB Design	**Semester**	3
Course Code	EE224	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	3:0:0	**Total**	100
Credits	03	**Exam. Duration**	3 Hours
Teaching Dept.	Electrical and Electronics Engineering		

Course Objective is to:

- Design and fabricate PCB for prototyping as well as in an industrial production environment
- Help students to innovate faster with electronic technology.
- Learn various types of PCBs, schematic design and routing techniques
- Learn post-processing of design and fabrication

Module-1	**RBT Levels: L1,L2**	**Hours: 08**
PCB Design fundamentals: Introduction to materials and components. **Schematic capture:** Creating circuit representations.		
Module-2	**RBT Level: L2, L3**	**Hours: 08**
Layout design: Component placement, routing, and optimization. **Design rules:** Adhering to industry standards and guidelines.		
Module-3	**RBT Level: L2, L3**	**Hours: 08**
Layer stacking: Configuring multilayer PCBs. **Signal integrity:** Addressing crosstalk, impedance, and grounding. **CAD tools:** Learning popular PCB design software.		
Module-4	**RBT Level: L1, L2, L3**	**Hours: 08**
Fabrication and assembly: Understanding manufacturing processes. **Testing and validation:** Verifying functionality and performance. **Troubleshooting:** Resolving common PCB design issues		
Module-5	**RBT Level: L1, L2, L3**	**Hours: 08**
Open ended Projects and Experiments		

Suggested Learning Resources: **Textbooks:**	
1	Michael D'souza, "PCB Design Printed Circuit Board", Kindle Edition, May 2017
Reference Books:	
1	PCB Design from Start to Finish Ebook By Cadence

Web links and Video Lectures (e-Resources): **www.altum.com/circuitmaker**
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning Mini Project

Course Outcomes: : At the end of the course the student will be able to:	
CO1	Understand a single layer and multilayer PCB
CO2	Create and Fabricate a PCB
CO3	Evaluate and Test PCB
CO4	Analyse in an intelligent manner, think better and perform better.

CO-PO Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	-	-	-	-	-	-	-	-	-	3	-	2	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	-	2	-
CO3	3	3	2	-	-	-	-	2	2	2	3	3	-	2	-
CO4	3	3	2	-	-	-	-	2	2	2	3	3	-	2	-

High-3, Medium-2, Low-1

Course Title	Universal Human Values	**Semester**	3
Course Code	HV207	**CIE**	50
Total No. of Contact Hours	30	**SEE**	50
No. of Contact Hours/Week	2:0:0	**Total**	100
Credits	02	**Exam. Duration**	03
Teaching Dept	Any Department		

Course Objective is to: This course is intended to:

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
- This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Module – 1	**RBT Levels: L1, L2**	**Hours: 06**

Introduction to Value Education:
Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations.

Module – 2	**RBT Levels: L1, L2**	**Hours: 06**

Harmony in the Human Being:
Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

Module-3	**RBT Levels: L1, L2**	**Hours: 06**

Harmony in the Family and Society:
Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationships, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationships, Understanding Harmony in Society, Vision for the Universal Human Order

Module-4	**RBT Levels: L1, L2**	**Hours: 06**

Harmony in the Nature/Existence: Understanding Harmony in Nature, Interconnectedness, self-regulation, and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence		
Module-5	**RBT Levels: L1, L2**	**Hours: 06**
Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession		

Suggested Learning Resources: **Textbooks:**	
1	The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034-47-1
2	The Teacher‟s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G
Reference Books:	
1	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3	The Story of Stuff (Book).
4	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5	Small is Beautiful - E. F Schumacher
6	Slow is Beautiful - Cecile Andrews

Web links and Video Lectures (e-Resources):

Value Education websites,

- https://www.uhv.org.in/uhv-ii,
- http://uhv.ac.in,
- http://www.uptu.ac.in
- Story of Stuff,
- http://www.storyofstuff.com
- Al Gore, An Inconvenient Truth, Paramount Classics, USA
- Charlie Chaplin, Modern Times, United Artists, USA
- IIT Delhi, Modern Technology – the Untold Story
- Gandhi A., Right Here Right Now, Cyclewala Productions
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
- https://fdp-si.aicte-india.org/8dayUHV_download.php
- https://www.youtube.com/watch?v=8ovkLRYXIjE
- https://www.youtube.com/watch?v=OgdNx0X923I
- https://www.youtube.com/watch?v=nGRcbRpvGoU
- https://www.youtube.com/watch?v=sDxGXOgYEKM

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

Teaching-Learning Process (General Instructions) These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
3. State the need for UHV activities and its present relevance in society and Provide real-life examples.
4. Support and guide the students for self-study activities. 5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evolution.
6. Encourage the students for group work to improve their creative and analytical skills.

Course Outcomes: At the end of the course, the student will be able to

Course outcome (Course Skill Set) At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature);

Expected to positively impact common graduate attributes like:

1. Ethical human conduct
2. Socially responsible behaviour
3. Holistic vision of life
4. Environmentally responsible work
5. Having Competence and Capabilities for Maintaining Health and Hygiene
6. Appreciation and aspiration for excellence (merit) and gratitude for all

CO1	They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO2	They would have better critical ability
CO3	They would also become sensitive to their commitment towards what they have understood (human values, human relationships and human society).
CO4	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	-	-	1	1	-	-	-	-	1
CO2	-	-	1	-	-	1	1	-	-	-	-	1
CO3	-	-	1	-	-	1	1	-	-	-	-	1
CO4	-	-	1	-	-	1	1	-	-	-	-	1

High-3, Medium-2, Low-1

Course Title	NSS – Phase 1	**Semester**	3
Course Code	NS208	**CIE**	50
Total No. of Contact Hours	25	**SEE**	0
No. of Contact Hours/week	0:2:0	**Total**	50
Credits	-----	**Exam. Duration**	-----
Teaching Dept	NSS		

Course Objective is to: National Service Scheme (NSS) will enable the students to

- Understand the community in which they work.
- Identify the needs and problems of the community and involve them in problem-solving.
- Develop among themselves a sense of social and civic responsibility and utilize their knowledge in finding practical solutions to individual and community problems
- Develop competence required for group living and sharing of responsibilities and gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
- Develop capacity to meet emergencies and natural disasters and practice national integration and social harmony

Module:1	**RBT Levels: L1, L2**	**Hours: 04**

Youth population in India and its characteristics:
Introduction to India: Physical, Socio-Economic and Demographic Background, Study on Indian Population Composition (Age composition), Youth composition, Youth policy, Importance of Youth Policy, Youth population in India, NSS as a Youth Organization.

Module:2	**RBT Levels: L1, L2**	**Hours: 03**

Fundamentals of NSS:
Introduction to NSS, Origin of NSS, Aims and Objectives of NSS, NSS Motto, NSS Emblem, NSS Badge, NSS Day.

Module:3	**RBT Levels: L1, L2**	**Hours: 03**

NSS Songs:
NSS Anthem (Hindi & Kannada), National Integration song, Rastriya sevayojane Madiharu. Uteh samajkeliye Uteh Uteh. Navellaru Ondagi Balona Banni. Hum Sab Mil ka rDeshka Apani.

Module:4	**RBT Levels: L1, L2**	**Hours: 15**

Activity Based Programmes:

A. Campus Activities:
Shramadhan – Plantation, Cleaning, Watering, Weeding, Any other activities.

Awareness Programmes – Seminar, Workshops, celebration of National and International days, Personality Development Programmes, Group Activities, etc

B : Off Campus Activities:
Rally, Jatha, Visit to Adopted villages, Swatchatha Programme, Visit and Conserving Ancient monuments and heritage site, Socio Economic Survey of village/slum, Nature Camp, Environmental Education

Course Outcomes: At the completion of the course. The student shall be able to	
CO1	Describe the concept of Youth and compare the international definitions of the term Youth.
CO2	Students will be able to appreciate our demographic advantage and its role in nation building.
CO3	Know the growth and evolution of NSS and its role in Nation building through community service
CO4	Visualize the signs, symbols, logo of NSS and understand their broader meaning.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	1	-	-	-	-	1
CO2	-	-	-	-	-	1	1	-	-	-	-	1
CO3	-	-	-	-	-	1	1	-	-	-	-	1
CO4	-	-	-	-	-	1	1	-	-	-	-	1

High-3, Medium-2, Low-1

Course Title	Physical Education (PE) (Sports and Athletics) – Phase 1	**Semester**	3
Course Code	PE208	**CIE**	50
Total No. of Contact Hours	25	**SEE**	0
No. of Contact Hours/Week	0:2:0	**Total**	50
Credits	--	**Exam. Duration**	------
Teaching Dept	PED		

Course Objective:

Physical education aims to develop all aspects of the human personality through physical and sports activities. Being a subject of science, it has its own value in society and human life. Physical Education is a form of one of the most effective means of education imparted through exercises, fun activities and sports. It is an integral part of the education system. It caters to the need for development of the students on physical, mental and social aspects.

Module – 1	**RBT Levels: L1, L2**	**Hours: 05**

Orientation:

Introduction of Physical Education and sports, Importance of Physical fitness and healthy lifestyle

A. Lifestyle
B. Fitness
C. Food & Nutrition
D. Health & Wellness
E. Pre-Fitness test

Module – 2	**RBT Levels: L1, L2**	**Hours: 15**

General Fitness & Components of Fitness:

A. Warming up (Free Hand exercises)
B. Strength – Push-up / Pull-ups
C. Speed – 30 Mtr Dash
D. Agility – Shuttle Run
E. Flexibility – Sit and Reach
F. Cardiovascular Endurance – Harvard Step Test.

Module - 3	**RBT Levels: L1, L2**	**Hours: 10**

Recreational Activities:

A. Postural deformities.
B. Stress management.
C. Aerobics.
D. Traditional Games.

Course Outcomes: At the completion of the course. The student shall be able to	
CO1	Understand the fundamental concepts and skills of Physical Education, Health,Nutrition and Fitness.
CO2	Familiarization of health-related Exercises, Sports for overall growth anddevelopment.
CO3	Create a foundation for the professionals in Physical Education and Sports.
CO4	Participate in the competition at regional/state / national/internationallevels.
CO5	Create consciousness among the students on Health, Fitness and Wellness indeveloping and maintaining a healthy lifestyle.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	-	-	1	1	-	-	-	-	1
CO2	-	-	1	-	-	1	1	-	-	-	-	1
CO3	-	-	1	-	-	1	1	-	-	-	-	1
CO4	-	-	1	-	-	1	1	-	-	-	-	1
CO5	-	-	1	-	-	1	1	-	-	-	-	1

High-3, Medium-2, Low-1

Course Title	Yoga for a Better Life - Phase 1	**Semester**	3
Course Code	YG208	**CIE**	50
Total No. of Contact Hours	25	**SEE**	0
No. of Contact Hours/week	0:2:0	**Total**	50
Credits	---	**Exam. Duration**	-----
Teaching Dept	YOGA		

Course Objectives:

- To enable the student to have good health.
- To practice mental hygiene.
- To possess emotional stability.
- To integrate moral values.
- To attain higher level of consciousness.

Semester - 3	**RBT Levels: L1, L2**	**Hours: 25**

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, importance of prayer Yogic practices for common man to promote positive health Rules to be followed during yogic practices by practitioner Yoga its misconceptions, Difference between yogic and non yogic practices.

Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12 count, 2 rounds.

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana Different types of Asanas

a. Sitting

1. Padmasana
2. Vajrasana

b. Standing

1. Vrikshana
2. Trikonasana

c. Prone line

1. Bhujangasana
2. Shalabhasana

d. Supine line

1. Utthitadvipadasana
2. Ardhahalasana

Suggested Learning Resources:

Textbooks:

1. Yogapravesha in Kannada by Ajitkumar
2. Light on Yoga by BKS Iyengar
3. Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly
4. Yoga Instructor Course hand book published by SVYASA University, Bengaluru
5. Yoga for Children –step by step – by Yamini Muthanna

Web links and Video Lectures (e-Resources):

Refer links

- **https://youtu.be/KB-TYlgd1wE**
- **https://youtu.be/aa-TG0Wg1Ls**

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as;

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse). If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- **Physical**
  1. Improved body flexibility and balance
  2. Improved cardiovascular endurance (stronger heart)
  3. Improved digestion
  4. Improved abdominal strength
  5. Enhanced overall muscular strength
  6. Relaxation of muscular strains
  7. Weight control
  8. Increased energy levels
  9. Enhanced immune system
- **Mental**
  1. Relief of stress resulting from the control of emotions
  2. Prevention and relief from stress-related disorders
  3. Intellectual enhancement, leading to improved decision-making skills
- **Spiritual**
  1. Life with meaning, purpose, and direction
  2. Inner peace and tranquility
  3. Contentment

Course Outcomes: At the completion of the course. The student shall be able to	
CO1	Understand the meaning, aim and objectives of Yoga.
CO2	Perform Suryanamaskar and able to Teach its benefits.
CO3	Understand and teach different types of Pranayama, Asanas by name, its importance, methods and benefits.
CO4	Instruct Kapalabhati and its need and importance.
CO5	Coach different types of Kriyas , method to follow and usefulness.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	-	-	1	1	-	-	-	-	1
CO2	-	-	1	-	-	1	1	-	-	-	-	1
CO3	-	-	1	-	-	1	1	-	-	-	-	1
CO4	-	-	1	-	-	1	1	-	-	-	-	1
CO5	-	-	1	-	-	1	1	-	-	-	-	1

High-3, Medium-2, Low-1

Course Title	Additional Mathematics	**Semester**	3
Course Code	DM209	**CIE**	50
Total No. of Contact Hours	30	**SEE**	50
No. of Contact Hours/week	2:0:0	**Total**	100
Credits	---	**Exam. Duration**	3 Hours
Teaching Dept	Mathematics		

Course objective is to:

- Develop the knowledge of numerical methods and apply them to solve transcendental and differential equations.
- Study the fundamental concepts of vector calculus viz. Gradient, curl and divergence
- Familiarize the importance of Integral calculus and Linear Algebra.

Module-1	**Numerical Analysis**	**RBT Levels L1, L2,L3**	**6 Hours**

Solution of algebraic and transcendental equations –Newton-Raphson methods. Finite differences, Interpolation and extrapolation using Newton's forward and backward difference formulae, Newton's divided difference Numerical integration: Trapezoidal rule, Simpson's $(1/3)$rd and $(3/8)$th rules, Weddle's rule.

Numerical Solution of Ordinary Differential Equations: Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order

Module-2	**Ordinary Differential Equations**	**RBTLevels L1, L2,L3**	**6 Hours**

Introduction to first-order ordinary differential equations pertaining to the applications for Computer Science & Engineering. Linear and Bernoulli's differential equations. Exact and reducible to exact differential equations - Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}\right)$.

Higher -order linear ordinary differential equations with constant coefficients - Inverse differential operator,

Module-3	**Integral Calculus**	**RBTLevels L1, L2,L3**	**6 Hours**

Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration

Module-4	**Vector Calculus**	**RBTLevels L1, L2,L3**	**6 Hours**

Scalar and vector fields. Gradient, directional derivative, curl and divergence - physical interpretation, solenoidal and irrational vector fields.

Module-5	**Linear Algebra**	**RBTLevels L1, L2,L3**	**6 Hours**

Row reduction and echelon forms- Consistency of System of Equations. Solution sets of linear equations by Gauss Seidel, Gauss Jordan,. Eigenvalues and eigenvectors Rayleigh's power method.

Suggested Learning Resources: **Textbooks:**	
1.	B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2.	Erwin Kreyszig - Advanced Engineering Mathematics, Wiley publication,10th edition, 2015
3	David C Lay: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018
Reference Books:	
1.	Srimanta Pal & Subodh C Bhunia - Engineering Mathematics, OxfordUniversity Press, 3rd Reprint, 2016.
2.	James Stewart: "Calculus" Cengage Publications, 7thEd., 2019.
3.	Gilbert Strang, Linear Algebra and its Applications, 5th Edition (2016).
4.	N.P Bali and Manish Goyal: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022. 4. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics"
Web links and Video Lectures (e-Resources): **https://youtu.be/Y7VWyyZ6B0g?si=rhxgG4vvrs3VS7mw** **https://youtu.be/zT83sJ5IrEE?si=Crb9_cIWw4tTJxmj** **https://youtu.be/9_m36W3cK74?si=h-bd19yVCgLF3VvW** **https://youtu.be/2DX8Vp1Q2-0?si=rQ76vQyXPATricZz** **https://youtu.be/AuUi_bUeTS4**	
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning: Course Seminars, Quiz, In class assignments.	

Course Outcomes: At the end of the course students will be able to	
CO1	Apply numerical methods to find the solution of algebraic and transcendental equations.
CO2	Apply numerical methods to find the solution of ordinary differential equations.
CO3	Apply the concept of change of order of integration and variables to evaluate multiple integrals and their usage in computing area and volume.
CO4	Use fundamentals of vectors to find gradient, curl and divergence.
CO5	Test the consistency and solve the system of liner equations .

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	2	-	-	-	-	-	-	-	2
CO2	3	2	-	2	-	-	-	-	-	-	-	2
CO3	3	2	-	2	-	-	-	-	-	-	-	2
CO4	3	2	-	2	-	-	-	-	-	-	-	2
CO5	3	2	-	2	-	-	-	-	-	-	-	2

High-3, Medium-2, Low-1

Course Title	Applied Mathematics IV for Electrical and Electronics Stream (ECE & EEE)	**Semester**	4
Course Code	ML251	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	2:2:0	**Total**	100
Credits	3	**Exam. Duration**	3 Hours
Teaching Dept	Mathematics		

Course Objective is to:

- Develop proficiency in solving ordinary and partial differential equations arising in engineering applications, using numerical methods.
- Develop the knowledge of solving difference equations using Z-Transform.
- To provide an insight into applications of complex variables.
- To introduce the concept of random variables, probability distributions, and specific discrete and continuous distributions with practical application in Computer Science Engineering and social life situations.
- Basics of hypothesis testing with emphasis on some commonly encountered hypotheses.

Module-1	**RBT Level L1, L2,L3**	**8 Hours**

Complex Analysis:
Complex Variables: Review of a function of a complex variable, limits, continuity, differentiability. Analytic Functions-Cauchy-Riemann equations in Cartesian and polar forms. Properties and construction of analytic functions.

Module-2	**RBT Level L1, L2,L3**	**8 Hours**

Complex Integrals:
Complex line Integrals - Cauchy's theorem and Cauchy's integral formula, Residue, poles, Cauchy's Residue theorem. Transformations: Conformal transformations-Discussion of transformations: $w=z^2, w=e^z, w=z+\left(\frac{1}{z}\right)\ (z\neq 0)$. Bilinear transformations.

Module-3	**RBT Level L1, L2,L3**	**8 Hours**

Z-Transform:
Definition, Standard Z-transforms, Damping and shifting rules, Problems. Inverse Z-transform. Difference equations and Solution of difference equations by using Z-transforms.

Module-4	**RBT Level L1, L2,L3**	**8 Hours**

Probability Distributions:
Random variables-discrete and continuous, probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions. Joint
probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient.

Module-5	RBT Level L1, L2,L3	8 Hours
Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.		

Suggested Learning Resources: **Textbooks:**	
1.	B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2021.
2.	Erwin Kreyszig –Advanced Engineering Mathematics, Wiley publication, 10th edition, 2018.
Reference Books:	
1.	Glyn James & Phil Dyke – Advanced Modern Engineering Mathematics, Pearson Education,5th edition, 2018.
2.	T. Veerarajan- Probability, Statistics and Random processes – Tata McGraw-Hill Education – 3rd edition -2017.
3.	Murray R Spiegel, John Schiller & R. Alu Srinivasan – Probability and Statistics – Schaum's outlines -4th edition-2012.
4.	Kishore S. Trivedi – Probability & Statistics with Reliability, Queuing and Computer Science Applications – John Wiley & Sons – 2nd edition – 2008.
5.	R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye – Probability and Statistics for Engineers and Scientists – Pearson Education – Delhi – 9th edition – 2012.
Web links and Video Lectures (e-Resources): **M1: https://youtu.be/Y6aOJXhfPYE?si=ibdsCem9IdmcUGu5** **M2: https://youtu.be/fRobjZ-hLHk?si=m6GnMenT7awCwuOE** **M3: https://youtu.be/zmxWaXvKfdc?si=Ae_c3Q0XaYnykHZQ** **M4: https://youtu.be/UftY0e2ilM4?si=hsk3VwayBrCiZE-w** **M5: https://youtu.be/qNqrHO3woyE?si=zlsEeM8JNd-6_PWO**	
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning • **Quiz** • **Assignment** • **Group Discussions**	

Course Outcomes: At the end of the course students will be able to:	
CO1	Use the concept of an analytic function and complex potential to solve the problems arising in electromagnetic field theory.
CO2	Utilize conformal transformation and complex integrals arising in image processing.
CO3	Apply Z-Transform techniques to solve difference equations
CO4	Explain the basic concepts of probability, random variables and probability distribution.
CO5	Formulate and test hypotheses about population parameters based on sample data.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	2	-	-	-	-	-	-	-	2
CO2	2	2	-	2	-	-	-	-	-	-	-	2
CO3	2	2	-	2	-	-	-	-	-	-	-	2
CO4	2	2	-	2	-	-	-	-	-	-	-	2
CO5	2	2	-	2	-	-	-	-	-	-	-	2

High-3, Medium-2, Low-1

Course Title	Induction Motor and Synchronous Generator	**Semester**	4
Course Code	EE252	**CIE**	50
Total No. of Contact Hours	45	**SEE**	50
No. of Contact Hours/week	3:0:0	**Total**	100
Credits	03	**Exam. Duration**	3 Hours
Teaching Dept.	Electrical and Electronics Engineering		

Course Objective is:

- To explain the constructional features of single-phase and three phase induction motors.
- To identify the performance characteristics of induction motors.
- To explain starting methods and speed control on three phase induction motors.
- To explain the constructional features and performance of synchronous generators.

Module-1	**RBT Levels: L1, L2**	**Hours: 09**

Three Phase Induction Motors: Review of concept and generation of rotating magnetic field, principle of operation, construction, classification and types - squirrel-cage, slip-ring. Slip, torque equation, torque-slip characteristic covering motoring, generating and braking regions of operation, maximum torque, significance of slip, simple numericals.

Module-2	**RBT Levels: L1, L2**	**Hours: 09**

Performance of Three-Phase Induction Motor: Phasor diagram of induction motor on no load and on load, equivalent circuit, losses, efficiency, no-load and blocked rotor tests, cogging and crawling, high torque rotors - double cage and deep rotor bars. Induction motor working as induction generator. Simple numericals.

Module-3	**RBT Levels: L1, L2**	**Hours: 09**

Starting and Speed Control of Three-Phase Induction Motors: Need for starter, direct on line, Star-Delta and autotransformer starting, rotor resistance starting. Speed control by voltage, frequency, and rotor resistance methods.

Single-Phase Induction Motor: Double revolving field theory and principle of operation, construction and operation of split-phase, capacitor start, and capacitor run, and shaded pole motors. Comparison of single-phase motors and applications. Simple numericals.

Module-4	**RBT Levels: L1, L2**	**Hours: 09**

Synchronous Generators: Armature windings, winding factors, e.m.f equation., harmonics – causes, reduction and elimination. Armature reaction, synchronous reactance, equivalent circuit. Alternator on load. Excitation control for constant terminal voltage. Voltage regulation. Open circuit and short circuit characteristics, assessment of reactance - short circuit ratio, voltage regulation by EMF, MMF and ZPF. Simple numericals.

Module-5	**RBT Levels: L1, L2**	**Hours: 09**

Performance of Synchronous Generators: Parallel operation of generators and load sharing. Methods of synchronization, synchronizing power, determination of X_d and X_q – slip test. Power angle characteristic (salient and non-salient pole), power angle diagram, reluctance power, capability curve for large turbo generators, hunting and damper windings.

Suggested Learning Resources:	
Textbooks:	
1	B.L Theraja and A.K. Theraja,"A Textbook of Electrical Technology: A. C. and D. C. Machines", Volume 2, S Chand, 23rd Edition 2005.
Reference Books:	
1	I.J. Nagrath D.P. Kothari, "Electrical Machines", Tata Mcgraw-Hill Publishing Company Limited, New Delhi, 2nd Edition, 2017.
Web links and Video Lectures (e-Resources): https://archive.nptel.ac.in/courses/108/105/108105131/	
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning • Seminar • Quiz • Cut-sectional view of AC machines	

Course Outcomes: At the end of the course, the student will be able to:	
CO1	Explain the construction, operation and classification of three phase Induction Motor.
CO2	Describe the performance characteristics and speed control of three phase Induction Motor.
CO3	Discuss the construction, operation and classification of single-phase Induction Motor.
CO4	Analyse different methods of voltage regulation in synchronous generators.
CO5	Obtain the performance characteristics of synchronous generators under parallel operation.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	-	-	-	-	-	2	-	-	-	-	1	2	3	-
CO2	1	3	-	-	-	-	2	-	-	-	-	1	2	3	-
CO3	1	-	-	-	-	-	2	-	-	-	-	1	2	3	-
CO4	1	3	-	-	-	-	2	-	-	-	-	1	2	3	-
CO5	1	3	-	-	-	-	2	-	-	-	-	1	2	3	-

High-3, Medium-2, Low-1

Induction Motor and Synchronous Machines Laboratory			
Course Code	EE253	**CIE Marks**	50
L:T:P:S	0:0:2	**SEE Marks**	50
Hrs. / Week	2	**Total Marks**	100
Credits	01	**Exam Hours**	03

Course Objectives: At the end of the course, the student will be able to:	
1	Conduct load test on single phase, three phase induction motor and synchronous generator.
2	Verify the performance characteristics of three phase induction motor.
3	Verify the voltage regulation of alternator by different methods.
4	Conduct test on synchronous motor to draw the performance curves.

Exp. No.	**List of Experiments**	**Hours**	**COs**
	Prerequisite		
	Basics of induction motor and synchronous machines, principle of operation, constructional details.		
	PART-A		
1	Load test on single phase induction motor.	2	1
2	Load test on three phase induction motor.	2	1
3	No load and blocked rotor tests on three phase induction motor.	2	2
4	Speed control of three phase induction motor by rotor resistance control.	2	2
5	Slip test on salient pole alternator for predetermination of voltage regulation.	2	3
	PART-B		
6	Synchronization of alternator with bus bars.	2	3
7	Pre-determination of voltage regulation of non-salient pole alternator by EMF and MMF methods.	2	4
8	Predetermination of voltage regulation of non-salient pole alternator by ZPF method.	2	4
9	V and Inverted V curves of synchronous motor.	2	5
10	Load test on induction generator.	2	5
	PART-C		
	Beyond Syllabus Virtual Lab Content https://www.youtube.com/watch?v=wRQWoq6wk2U&list=PL8Jq4IW43hato3pOQw24QvPJ5N6yj-FSd		

Suggested Learning Resources:	
Textbooks	
1	B.L Theraja and A.K. Theraja, "A Textbook of Electrical Technology: A. C. and D. C. Machines", Volume 2, S Chand,23rd Edition 2005.
Reference Books:	
1	I.J. Nagrath D.P. Kothari, "Electrical Machines", Tata Mcgraw-Hill Publishing Company Limited, New Delhi, 2nd Edition, 2017.

Web links and Video Lectures (e-Resources):
https://www.youtube.com/watch?v=MP0pfdSiU9A&list=PL5TKV1tzb09lx62sPBmho6WJZX5WWFzUr

Activity-Based Learning (Suggested Activities in Class) / Practical Based learning
Poster presentation on machine cut sections.

Course Outcomes: At the end of the course, the student will be able to	
CO1	Perform load test on single phase and three phase induction motor to assess its performance.
CO2	Conduct test on induction motor to pre-determine the performance characteristics.
CO3	Evaluate the performance of synchronous generators from the test data and assess the performance of synchronous generator connected to infinite bus.
CO4	Compute the voltage regulation of synchronous generator using the test data obtained in the laboratory.
CO5	Conduct test on synchronous motor to draw the performance curves.

CO-PO Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	-	-	-	2	2	-	3	3	1	1	2	3	-
CO2	3	1	-	-	-	2	2	-	3	3	1	1	2	3	-
CO3	3	1	-	-	-	2	2	-	3	3	1	1	2	3	-
CO4	3	1	-	-	-	2	2	-	3	3	1	1	2	3	-
CO5	3	1	-	-	-	2	2	-	3	3	1	1	2	3	-

High-3, Medium-2, Low-1

Course Title	Power Electronics	**Semester**	4
Course Code	EE254	**CIE**	50
Total No. of Contact Hours	45	**SEE**	50
No. of Contact Hours/week	3:0:0	**Total**	100
Credits	03	**Exam. Duration**	3 Hours
Teaching Dept.	Electrical and Electronics Engineering		

Course Objective is to:

- Give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics.
- Understand power diode characteristics, types, their operation and the effects of power diodes on RL circuits.
- Analyze the techniques for design and analysis of single phase diode rectifier circuits.
- Know the different power transistors, thyristors, control characteristics, steady state and switching characteristics.
- Design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and voltage controllers.

Module-1	**RBT Level: L1,L2**	**Hours: 09**

Introduction: Applications of power electronics, types of power electronic circuits, peripheral effects, control characteristics.
Power Diodes: Introduction, diode characteristics, reverse recovery characteristics, power diode types, silicon carbide diodes, silicon carbide Schottky diodes.
Diode rectifiers: Introduction, bridge rectifiers with R and RL load analysis.

Module-2	**RBT Level: L1,L2**	**Hours: 09**

Power Transistors: Introduction, power MOSFETs – steady state characteristics, switching characteristics bipolar junction transistors – steady state characteristics, switching characteristics, switching limits, IGBTs, MOSFET gate drive, BJT base drive, isolation of gate and base drives, pulse transformers and opto-couplers.

Module-3	**RBT Level: L1,L2**	**Hours: 09**

Thyristors: Introduction, thyristor characteristics, two-transistor model of thyristor, thyristor turn- on, thyristor turn-off, study on thyristor types, series operation of thyristors, parallel operation of thyristors, di/dt protection, dv/dt protection.

Module-4	**RBT Level : L1,L2**	**Hours: 09**

Controlled Rectifiers: Introduction, single phase half wave circuit with R and RL load, single-phase full converters with RL Load.
AC Voltage Controllers: Introduction, principle of phase control and on –off control, single-phase full-wave controllers with resistive loads, single- phase full-wave controllers with inductive loads.

Module-5	**RBT Level : L1,L2**	**Hours: 09**

DC-DC Converters: Introduction, principle of step down and step up chopper with RL load, performance parameters, DC-DC converter classification.
DC-AC Converters: Introduction, principle of operation single-phase bridge inverters, three phase bridge inverters, voltage control of single-phase inverters, current source inverters.

Suggested Learning Resources:	
Textbooks:	
1	Mohammad H Rashid, "Power Electronics: Circuits Devices and Applications", Pearson 4th edition, 2014.
Reference Books:	
1	P.S. Bimbhra, "Power Electronics", Khanna Publishers, 5th Edition, 2012.
2	Ned Mohan, "Power Electronics: Converters, Applications and Design", Wiley 3rd Edition, 2014.
3	Daniel W Hart, "Power Electronics", McGraw Hill, 1st Edition, 2011.
4	M.D. Singh, K B Khanchandani, "Power Electronics", TMH, 2nd Edition, 2008.

Web links and Video Lectures (e-Resources):

1. NPTEL Lecture on "Power Electronics" http://nptel.ac.in/courses/108105066/
2. NPTEL Lecture on "Power Electronics" http://nptel.ac.in/courses/108101038/#
3. https://www.rohm.com/electronics-basics/sic/what-are-sic-semiconductors
4. https://gansystems.com/design-center/application-not

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

Presentation by students, execution of projects.

Course Outcomes: At the end of the course, the student will be able to	
CO1	Understand the working of power semiconductor devices, sketch their characteristics and select a power device for a given application.
CO2	Analyze the working of diode circuits and rectifiers, switching behavior of different types of power semiconductor devices, and explain gate drive requirements and need for protection circuits.
CO3	Outline different types of thyristors, their gate characteristics and gate control requirements.
CO4	Explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and voltage controllers.

CO-PO Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-

High-3, Medium-2, Low-1

Power Electronics Laboratory			
Course Code	EE255	**CIE Marks**	50
L:T:P:S	0:0:2	**SEE Marks**	50
Hrs. / Week	2	**Total Marks**	100
Credits	01	**Exam Hours**	03

Course Objectives: At the end of the course, the student will be able to:	
1	Know the characteristics of semiconductor devices to discuss their performance.
2	Learn the methods of triggering the SCR.
3	Understand the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.
4	Control the speed of a DC motor, universal motor and stepper motors.
5	Realize the performance of single phase full bridge inverter connected to resistive load.

Exp. No.	List of Experiments	Hours	COs
	Prerequisite Experiments / Demo		
	Demo on knowing device terminal identification.	2	
	PART-A		
1	Static characteristics of SCR.	2	1
2	Static characteristics of MOSFET and IGBT.	2	1
3	Characteristics of TRIAC.	2	1
4	SCR turn on circuit using synchronized UJT relaxation oscillator.	2	2
5	SCR digital triggering circuit for a single phase controlled rectifier and ac voltage regulator.	2	2
6	Single phase controlled full wave rectifier with R load, R-L load with and without freewheeling diode.	2	3
	PART-B		
7	AC voltage controller using TRIAC and DIAC combination connected to R and RL loads.	2	3
8	Speed control of DC motor using single semi converter.	2	4
9	Speed control of stepper motor.	2	4
10	Speed control of universal motor using AC voltage regulator.	2	4
11	Speed control of a separately excited DC Motor using an IGBT or MOSFET chopper.	2	4
12	Single phase MOSFET/IGBT based PWM inverter.	2	5
	PART-C		
	Beyond Syllabus Virtual Lab Content A minimum of three experiments to be simulated using (Freeware Software Package)		

Suggested Learning Resources:	
Textbooks:	
1	Mohammad H Rashid, "Power Electronics: Circuits Devices and Applications", Pearson 4th edition, 2014.
Reference Books:	
1	P.S. Bimbhra, "Power Electronics, Khanna Publishers", 5th Edition, 2012.
Web links and Video Lectures (e-Resources	
https://www.youtube.com/playlist?list=PLBKH0K5j2gRgdIAzco_g9ZpzpavCn3fyd	
Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning	
Design the control circuit for inverters and converters.	

Course Outcomes: At the end of the course, the student will be able to	
CO1	Obtain static characteristics of semiconductor devices to discuss their performance.
CO2	Trigger the SCR by different methods
CO3	Verify the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.
CO4	Control the speed of a DC motor, universal motor and stepper motors.
CO5	Verify the performance of single-phase full bridge inverter connected to resistive load.

CO-PO Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	-	-	-	-	-	2	2	-	-	-	2	-
CO2	2	2	-	-	-	-	-	-	2	2	-	-	-	2	-
CO3	2	2	-	-	-	-	-	-	2	2	-	-	-	2	-
CO4	2	2	-	-	-	-	-	-	2	2	-	-	-	2	-
CO5	2	2	-	-	-	-	-	-	2	2	-	-	-	2	-

High-3, Medium-2, Low-1

Course Title	Control Systems	**Semester**	4
Course Code	EE256	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	2:0:2	**Total**	100
Credits	03	**Exam. Duration**	3 Hours
Teaching Dept.	Electrical and Electronics Engineering		

Course Objective is to:

- Analyze and model electrical and mechanical system using analogous systems.
- Formulate transfer functions using block diagram and signal flow graphs.
- Analyze the stability of control system, ability to determine transient and steady state time response.
- Illustrate the performance of a given system in time and frequency domains, stability analysis using root locus and bode plots.
- Discuss stability analysis using nyquist plots, design controller and compensator for a given specification.

Module-1	**RBT Levels: L1, L2**	**Hours: 08**

Introduction to Control Systems: Introduction, classification of control systems.
Mathematical models of physical systems: Modelling of mechanical system elements, electrical systems, analogous systems, transfer function, single input single output systems, procedure for deriving transfer functions, servomotors, synchros, gear trains.

Module-2	**RBT Levels: L2, L3**	**Hours: 08**

Block Diagram: Block diagram of a closed loop system, procedure for drawing block diagram and block diagram reduction to find transfer function.
Signal Flow Graphs: Construction of signal flow graphs, basic properties of signal flow graph, signal flow graph algebra, construction of signal flow graph for control systems.

Module-3	**RBT Levels: L2, L3**	**Hours: 08**

Time Domain Analysis: Standard test signals, time response of first order systems, time response of second order system, steady state error and error constants.
Routh Stability Criterion: BIBO stability, necessary conditions for stability, Routh stability criterion, difficulties in formulation of Routh table, application of Routh stability criterion to linear feedback systems, relative stability analysis.

Module-4	**RBT Levels: L2, L3**	**Hours: 08**

Root locus Technique: Introduction, root locus concepts, construction of root loci, rules for the construction of root locus.
Frequency Response Analysis: Co-relation between time and frequency response – 2^{nd} order systems only.
Bode Plots: Basic factors G(jw)/H(jw), General procedure for constructing bode plots, computation of gain margin and phase margin.

Module-5	**RBT Levels: L2, L3, L4**	**Hours: 08**

Nyquist plot: Principle of argument, nyquist stability criterion, assessment of relative stability using nyquist criterion.
Design of Control Systems: Introduction, design with the PD controller, design with the PI controller, design with the PID controller, design with phase-lead controller, design with phase - lag controller, design with lead-lag controller.

Practice Experiments:

1. Experiment to draw the speed torque characteristics of (i) AC servo motor (ii) DC servo motor.
2. Experiment to determine frequency response of a second order system.
3. To design a passive RC lead compensating network for the given specifications, viz, the maximum phase lead and the frequency at which it occurs and to obtain the frequency response.
4. a) To design a passive RC lag compensating network for the given specifications, viz, the maximum phase lag and the frequency at which it occurs and to obtain the frequency response.
   b) To determine experimentally the transfer function of the lag compensating network.
5. To study a second order system and verify the effect of (a) P, (b) PI, (c) PD and (d) PID controller on the step response.
6. a) To simulate a typical second order system and determine step response and evaluate time response specifications.
   b) To evaluate the effect of pole location on stability.
7. For a given transfer function, obtain root locus plot and find the range of gain for stability.
8. For a given transfer function, obtain bode plot and find the gain margin, phase margin and comment on the system stability.

Open ended experiments leading to guided projects:

Performance of different controller types on speed control of DC motor.

Suggested Learning Resources:

Textbooks:

1	Nagoor Kani, "Control Systems", RBA Publications, 5th Edition Jan 2017.
2	Dr. Ganesh Rao, "Control Systems", Publisher, Pearson Education India, 2010.

Reference Books:

1	Farid Golnaraghi, Benjamin C, "Automatic Control Systems", Kuo, Wiley, 9th Edition, 2010.
2	M. Gopal, "Control Systems, Principles, and Design", McGaw Hill 4th Edition, 2012.
3	S. Salivahanan et al, "Control Systems, Engineering", Pearson, 1st Edition, 2015.
4	Anand Kumar, "Control Systems", PHI, 2nd Edition, 2014.

Web links and Video Lectures (e-Resources):

https://archive.nptel.ac.in/courses/107/106/107106081/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

To simulate a DC position control system and obtain its step response.

Course Outcomes: At the end of the course, the student will be able to	
CO1	Analyze and model electrical and mechanical system using analogous.
CO2	Formulate transfer functions using block diagram and signal flow graphs.
CO3	Analyze the stability of control system, ability to determine transient and steady state time response.
CO4	Analyze the stability of control system, ability to determine transient and steady state time response.
CO5	Discuss stability analysis using Nyquist plots, design controller and compensator for a given specification.

CO-PO Mapping															
CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	-	2	-	-	-	-	2	2	-	2	2	3	3
CO2	3	3	-	2	-	-	-	-	2	2	-	2	2	3	3
CO3	3	3	-	2	-	-	-	-	2	2	-	2	2	3	3
CO4	3	3	-	2	-	-	-	-	2	2	-	2	2	3	3
CO5	3	3	2	2	-	-	-	-	2	2	-	2	2	3	3

High-3, Medium-2, Low-1

Course Title	Electromagnetic Theory	**Semester**	4
Course Code	EE261	**CIE**	50
Total No. of Contact Hours	45	**SEE**	50
No. of Contact Hours/week	2:0:2	**Total**	100
Credits	03	**Exam. Duration**	3 Hours
Teaching Dept.	Electrical and Electronics Engineering		

Course Objective is to:

- Study the different coordinate systems, physical significance of divergence, curl and gradient.
- Learn the applications of coulomb's law and gauss law to different charge distributions and the applications of laplace's and poisson's equations to solve real time problems on capacitance of different charge distributions.
- Learn the physical significance of biot-savart's, ampere's law and stokes' theorem for different current distributions, infer the effects of magnetic forces, materials and inductance.
- Know the physical interpretation of maxwell's equations and applications for plane waves for their behavior in different media.
- Acquire knowledge of poynting theorem and its application of power flow transforms.

Module-1:	**RBT Levels: L1, L2, L3**	**Hours: 09**

Revision of Vector Calculus

Coulomb's Law, Electric Field Intensity and Flux Density: Experimental law of coulomb, electric field intensity, field due to continuous volume charge distribution, field of a line charge, field due to sheet of charge, electric flux density, numerical problems.

Module-2:	**RBT Levels: L1, L2, L3**	**Hours: 09**

Gauss's Law and Divergence: Gauss' law, application of gauss' law to point charge, line charge, surface charge and volume charge, point (differential) form of gauss law, divergence. Maxwell's first equation (Electrostatics), vector operator and divergence theorem, numericals.

Energy expanded or work done in moving a point charge in a free space.

Module-3:	**RBT Levels: L1, L2, L3**	**Hours: 09**

Poisson's and Laplace's Equations: Derivation of Poisson's and laplace's equations, examples of the solution of laplace's equation, numerical problems on laplace's equation.

Steady Magnetic Field: Biot-savart law, ampere's circuital law, curl, stokes' theorem, magnetic flux and magnetic flux density.

Module-4:	**RBT Levels: L2, L3**	**Hours: 09**

Magnetic Forces: Force on a moving charge, differential current elements, force between differential current elements, numericals.

Magnetic Materials: Magnetization and permeability, magnetic boundary conditions, the magnetic circuit, numericals.

Module-5:	**RBT Levels: L2, L3**	**Hours: 09**

Faraday's law of Electromagnetic Induction: Integral form and point form, numerical problems, inconsistency of ampere's law with continuity equation, displacement current, conduction current, derivation of maxwell's equations in point form, and integral form, maxwell's equations for different media, numericals.

Uniform Plane Wave: Wave propagation in free space, uniform plane wave, derivation of plane wave equations from maxwell's equations, poynting's theorem, skin effect or depth of penetration, numericals.

Suggested Learning Resources: **Textbooks:**	
1	W.H. Hayt and J.A. Buck, "Engineering Electromagnetics", Tata McGraw-Hill, 8th Edition, 2014.
Reference Books:	
1	Matthew N.O, Sadiku, "Elements of Electromagnetics", Oxford University press, 4th Edition, 2007.
2	Edward C. Jordan, Keith G. Balmain, "Electromagnetic Waves and Radiating Systems," PHI, 2nd Edition, 2020
3	Joseph Edminister, "Electromagnetics", Schaum Outline Series, McGraw Hill, 2002.
4	N. Narayana Rao, "Fundamentals of Electromagnetics for Engineering", Pearson, 1st Edition 2008
Web links and Video Lectures (e-Resources) https://archive.nptel.ac.in/courses/108/104/108104087/	
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning 1) Quiz 2) Peer to peer learning 3) Seminar	

Course Outcomes: At the end of the course, the student will be able to	
CO1	Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
CO2	Apply gauss law to evaluate electric fields due to different charge distributions and volume charge distribution by using divergence theorem.
CO3	Determine potential and energy with respect to point charge and capacitance using laplace equation and apply biot-savart's and ampere's laws for evaluating magnetic field for different current configurations.
CO4	Calculate magnetic force, potential energy and magnetization with respect to magnetic materials and voltage induced in electric circuits.
CO5	Apply maxwell's equations for time varying fields, EM waves in free space.

CO-PO Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Course Title	Digital Systems Design Using VHDL	**Semester**	4
Course Code	EE262	**CIE**	50
Total No. of Contact Hours	45	**SEE**	50
No. of Contact Hours/week	2:0:2	**Total**	100
Credits	03	**Exam. Duration**	3 Hours
Teaching Dept.	Electrical and Electronics Engineering		

Course objective: This course will enable students to:
- Use the industry-standard hardware description language VHDL into the digital design process.
- Design VHDL models ranging in complexity from a simple adder to more complex circuits.
- Understand the synthesis and testing of the models

Module-1:	**RBT Levels: L1, L2, L3**	**Hours: 09**

Review of Logic Design Fundamentals:
Combinational logic, Boolean Algebra and Algebraic Simplification, Karnaugh maps, Designing with NAND and NOR gates, Hazards in combinational Networks, Flipflop and Latches, Mealy Sequential Network Design, Design of Moore Sequential Network, Equivalent states and reduction of state Tables, Synchronous Design, Tristate Logic and Buses

Module-2:	**RBT Levels: L1, L2, L3**	**Hours: 09**

Introduction to VHDL:
VHDL Description of Combinational Networks, Modeling Flipflops using VHDL Processes, VHDL Models for a Multiplexer, Modeling a sequential Machine, Variables, signals, and constants, Arrays, VHDL operators, VHDL Functions, VHDL Procedures, Packages and Libraries.

Module-3:	**RBT Levels: L1, L2, L3**	**Hours: 09**

Styles of Descriptions: VHDL Data types, VHDL Styles of Description
Data flow Description: Highlights of Data flow Description, Structure of Data flow Description, Data type-vectors, Common VHDL programming Errors

Module-4:	**RBT Levels: L2, L3**	**Hours: 09**

Designing with programmable Logic Devices: Read only memories, Programmable Logic Arrays, Programmable Array Logic, Other sequential programmable Logic Devices (PLDs), Generics, Generate statements.
Design of Networks for Arithmetic Operations: Design of serial Adder with Accumulator, Design of Binary Multiplier, Multiplication of signed Binary Numbers, Design of Binary Divider

Module-5:	**RBT Levels: L2, L3**	**Hours: 09**

Synthesis: Highlights of synthesis, synthesis information from entity and module, Mapping process in the hardware domain- Mapping of signal assignment, variable L1, L2, L3 assignment, if statements, else-if statements, loop statement.

Hardware Testing and Design for Testability: Testing Combinational Logic, Testing Sequential Logic

Suggested Learning Resources: **Textbooks:**	
1	"Digital Systems Design using VHDL", Charles H. Roth, Jr., The University of Texas at Austin. 2006 reprint, Thomson Asia Pte Ltd, Singapore
2	"HDL Programming VHDL and Verilog", Nazeih M. Botros, 2009 reprint, Dreamtech press
Reference Books:	
1	"VHDL for Programmable Logic", Kevin Skahill, Pearson education, 2006

Course Outcomes: At the end of the course the student will be able to:	
CO1	Understand the basic concepts of Digital Design
CO2	Implement various Combinational and sequential circuits using VHDL descriptions. Write simple VHDL programs in different styles.
CO3	Design and verify the functionality of digital circuits (PLA, PAL, PLD) and Arithmetic Operations.
CO4	Identify the suitable Abstraction level for a particular digital design.
CO5	Write the programs more effectively using Verilog tasks and directives. Perform timing and delay Simulation.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	-	-	-	-	2	2	2	3	3	-	2	-
CO2	3	3	2	-	-	-	-	2	2	2	3	3	-	2	-
CO3	3	3	2	-	-	-	-	2	2	2	3	3	-	2	-
CO4	3	3	2	-	-	-	-	2	2	2	3	3	-	2	-
CO5	3	3	2	-	-	-	-	2	2	2	3	3	-	2	-

High-3, Medium-2, Low-1

Course Title	Engineering Material	**Semester**	4
Course Code	EE263	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	2:0:2	**Total**	100
Credits	3	**Exam. Duration**	3 Hours
Teaching Dept	Electrical and Electronics Engineering		

Course Objective is to:

- To understand wave particle duality, tunnelling phenomenon, electron theory of metals.
- To understand the free electron theory of conduction in metals.
- To understand the polarization under static fields, behavior of dielectrics in alternating fields, Inorganic materials, organic materials,), resins and varnishes, liquid insulators.
- To understand the mechanism of conduction in semiconductors.
- To understand the magnetic materials, their classification and magneto materials.

Module-1	**RBT Levels: L1, L2**	**Hours: 08**

THEORY OF METALS

Elementary Quantum mechanical ideas: Wave Particle Duality, Wave function, schrodinger's equation, operator notation, expected value, Infinite Potential Well: A confined electron. Finite Potential Barrier: Tunnelling Phenomenon. Free electron theory of metals: Electron in a linear solid, Fermi energy, Degenerate states, Number of States, Density of States, Population Density. Fermi-Dirac Distribution Function. Thermionic Emission: Richardson's Equation, Schottky Effect.Contact Potential: Fermi level at Equilibrium.

Module-2	**RBT Levels: L1, L2**	**Hours: 08**

FREE ELECTRON THEORY OF CONDUCTION IN METAL

Crystalline structure: Simple cubic structure, Body centered cubic, Face centered cubic. Band Theory of Solids. Effective mass of Electron. Thermal Velocity of Electron at equilibrium. Electron mobility, conductivity and resistivity.

Module-3	**RBT Levels: L1, L2**	**Hours: 08**

DIELECTRICS and INSULATING MATERIALS

DIELECTRICS: Dielectric, polarization under static fields- electronic ionic and dipolar polarizations, behavior of dielectrics in alternating fields, Factors influencing dielectric strength and capacitor materials. Insulating materials, complex dielectric constant, dipolar relaxation and dielectric loss.

INSULATING MATERIALS: Inorganic materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and bakelite), resins and varnishes, liquid insulators (transformer oil) gaseous insulators (air, SF6 and nitrogen) and ageing of insulators.

Module-4	**RBT Levels: L1, L2**	**Hours: 08**

SEMICONDUCTORS

Mechanism of conduction in semiconductors, density of carriers in intrinsic semiconductors, the energy gap, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors.

Module-5	RBT Levels: L1, L2	Hours: 08

Magnetic materials

Magnetic materials: Classification of magnetic materials- origin of permanent magnetic dipoles, ferromagnetism, Magnetic Domains: Domain structure, Domain Wall motion, Hysteresis loop, Eddy current losses, Demagnetization, hard and soft magnetic materials, magneto materials used in electrical machines, instruments and relays.

Suggested Learning Resources:

Textbooks:

1	Bhadra Prasad Pokharel and Nava Raj Karki,"Electrical Engineering Materials", Sigma offset Press,Kamaladi, Kathmandu, Nepal,2004.
2	R.C. Jaeger, "Introduction to Microelectronic Fabrication- Volume IV", Addison Wesley publishingCompany,Inc., 1988.
3	Introduction to Electrical Engineering Materials 4th Edn. 2004 Edition by Indulkar C, S. Chand &Company Ltd-New Delhi.
4	Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi.

Web links and Video Lectures (e-Resources):

www.nptel.ac.in

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars
- Quizzes

Course Outcomes: At the end of the course, the student will be able to	
CO1	Explain wave particle duality, tunnelling phenomenon, electron theory of metals.
CO2	Explain the free electron theory of conduction in metals.
CO3	Explain the polarization under static fields, behavior of dielectrics in alternating fields, Inorganic materials, organic materials,), resins and varnishes, liquid insulators.
CO4	Explain the mechanism of conduction in semiconductors.
CO5	Explain the magnetic materials, their classification and magneto materials.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-

High-3, Medium-2, Low-1

Course Title	Computer Organization and Architecture	**Semester**	4
Course Code	EE264	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	2:0:2	**Total**	100
Credits	3	**Exam. Duration**	3 Hours
Teaching Dept	Electrical and Electronics Engineering		

Course Objective is to:

- Explain the basic sub systems of a computer, their organization, structure and operation.
- Illustrate the concept of programs as sequences of machine instructions.
- Demonstrate different ways of communicating with I/O devices
- Describe memory hierarchy and concept of virtual memory.
- Illustrate organization of simple pipelined processor and other computing systems.

Module-1	**RBT Levels: L1, L2**	**Hours: 08**
Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance -Processor Clock, Basic Performance Equation. **Machine Instructions and Programs:** Numbers, Arithmetic Operations and Characters, IEEE standard for Floating point Numbers, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing		
Module-2	**RBT Levels: L1, L2**	**Hours: 08**
Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions		
Module-3	**RBT Levels: L1, L2**	**Hours: 08**
Input/ Output Organization: Accessing I/O Devices, Interrupts -Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct Memory Access.		
Module-4	**RBT Levels: L1, L2**	**Hours: 08**
Memory System: Basic Concepts, Semiconductor RAM Memories-Internal organization of memory chips, Static memories, Asynchronous DRAMS, Read Only Memories, Cash Memories, Virtual Memories, Secondary StorageMagnetic Hard Disks		
Module-5	**RBT Levels: L1, L2**	**Hours: 08**
Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Microprogrammed Control		

Course Outcomes: At the end of the course, the student will be able to :	
CO1	Explain the basic organization of a computer system
CO2	Describe the addressing modes, instruction formats and program control statement.
CO3	Explain different ways of accessing an input/ output device including interrupts.
CO4	Illustrate the organization of different types of semiconductor and other secondary storage memories.
CO5	Illustrate simple processor organization based on hard wired control and microprogrammed control.

CO-PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-

High-3, Medium-2, Low-1

Course Title	Data Structures using C	**Semester**	4
Course Code	EE271	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	2:0:0	**Total**	100
Credits	02	**Exam. Duration**	3 Hours
Teaching Dept.	Electrical and Electronics Engineering		

Course Objective is to:

- Identify different data structures in the C programming language.
- Appraise the use of data structures in problem-solving.
- Implement data structures using C programming language.

Module-1	**RBT Levels: L1, L2**	**Hours: 08**
Data structures, classifications: primitive and non-primitive, arrays, strings, built-in functions, user defined functions, structures, unions and pointers and dynamic memory allocations using C programming.		
Module-2	**RBT Levels: L1, L2, L3**	**Hours: 08**
Stacks: Definition, stack operations, array representation of stacks. Stack applications: polish notation, infix to postfix conversion, evaluation of postfix expression.		
Module-3	**RBT Levels: L1, L2, L3**	**Hours: 08**
Queues: Definition, array representation, queue operations, circular queues, **Linked Lists:** Definition, representation of linked lists in memory, types of linked list. singly linked list operations: Insertion begin, insert end, delete begin, and delete end.		
Module-4	**RBT Levels: L1, L2, L3**	**Hours: 08**
Trees: terminology, binary trees, properties of binary trees, array and linked representation of binary trees, binary tree traversals – in order, post order, pre-order, binary search trees, selection trees, forest.		
Module-5	**RBT Levels: L1, L2, L3**	**Hours: 08**
Graphs: Definitions, terminologies, matrix and adjacency list representation of graphs, graph operations: DFS, BFS. **Minimum Spanning Trees**: Prims, Kruskal. **Sorting:** Insertion sort, Merge Sort.		

Practice Experiments:

1. Write a C programme that implements dynamic memory allocation.
2. Write a C programme that implements stack and its operations.
3. Write a C programme that implements the queue and its operations.
4. Write a C programme that uses stack operations to perform the conversion of infix expression into postfix expression.
5. Write a C programme that uses functions to perform the creation, insertion, deletion and traversal operations on a singly linked list.

6. Write a C programme that uses functions to perform the following:
   i. Create a binary tree of integers
   ii. Traverse the above binary tree in pre order, in order and post order.
7. Write a C programme to find the minimum spanning tree using the Prim's algorithm.

Write a C programme to implement the Kruskal algorithm.

Open ended experiments leading to guided projects:

https://www.placementpreparation.io/blog/dsa-project-ideas-for-beginners/

Suggested Learning Resources:

Textbooks:

1	Reema Thareja, "Data Structures using C", Oxford Publications, 2nd Edition ,2014.

Reference Books:

1	E Balagurusamy, "Data Structures using C", McGraw Hill Publications, 1st Edition, 2017.
2	Yashwanth Kanetkar, "Data Structures through C", BPB Publications 4th Edition , 2022.

Web links and Video Lectures (e-Resources):

https://onlinecourses.swayam2.ac.in/nou23_cs13/preview

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

https://codegnan.com/blogs/data-structure-and-algorithm-project-ideas/

Course Outcomes: At the end of the course, the student will be able to	
CO1	Understand the concept of dynamic memory management and data structures such as arrays, strings, linked lists, stacks, queues and graphs.
CO2	Study trees and graphs along with their basic operations.
CO3	Apply the different linear data structures like stack and queue to various computing problems.
CO4	Implement different types of trees and apply them to problem solutions.
CO5	Study different techniques for solving problems like sorting, insertion, deleting and searching.

CO-PO Mapping

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	-	-	-	-	-	2	2	-	2	-	3	-
CO2	2	2	-	-	-	-	-	-	2	2	-	2	-	3	-
CO3	2	2	-	-	-	-	-	-	2	2	-	2	-	3	-
CO4	2	2	-	-	-	-	-	-	2	2	-	2	-	3	-
CO5	2	2	-	-	-	-	-	-	2	2	-	2	-	3	-

High-3, Medium-2, Low-1

Course Title	Introduction to Python Programming	**Semester**	4
Course Code	EE272	**CIE**	50
Total No. of Contact Hours	30	**SEE**	50
No. of Contact Hours/week	2:0:0	**Total**	100
Credits	2	**Exam. Duration**	3 Hours
Teaching Dept	Electrical and Electronics Engineering		

Course Objective is to:

- Learn the syntax and semantics of the Python programming language.
- Illustrate the process of structuring the data using lists, tuples
- Appraise the need for working with various documents like Excel, PDF, Word and Others.
- Demonstrate the use of built-in functions to navigate the file system.
- Implement the Object Oriented Programming concepts in Python.

Module-1	**RBT Levels: L1, L2**	**Hours: 06**

Python Basics: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, **Flow control:** Boolean Values, Comparison Operators, Boolean Operators,Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules,Ending a Program Early with sys.exit(), **Functions:** def Statements with Parameters, Return Values and return Statements,The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number

Module-2	**RBT Levels: L1, L2, L3**	**Hours: 06**

Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References,
Dictionaries and Structuring Data: The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things

Module-3	**RBT Levels: L1, L2, L3**	**Hours: 06**

Manipulating Strings: Working with Strings, Useful String Methods, Project: Password Locker, Project: Adding Bullets to Wiki Markup
Reading and Writing Files: Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module,Saving Variables with the print.format() Function, Project: Generating Random Quiz Files, Project: Multiclipboard,

Module-4	RBT Levels: L1, L2, L3	Hours: 06

Organizing Files: The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates,Project: Backing Up a Folder into a ZIP File,

Debugging: Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE‟s Debugger.

Module-5	RBT Levels: L1, L2, L3	Hours: 06

Classes and objects: Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying,

Classes and functions: Time, Pure functions, Modifiers, Prototyping versus planning,

Classes and methods: Object-oriented features, Printing objects, Another example, A more complicated example,Theinit method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation,

Programming Exercises:

1. a. Develop a program to read the student details like Name, USN, and Marks in three subjects. Display the student details, total marks and percentage with suitable messages.
   b. Develop a program to read the name and year of birth of a person. Display whether the person is a senior citizen or not.
2. a. Develop a program to generate Fibonacci sequence of length (N). Read N from the console.
   b. Write a function to calculate factorial of a number. Develop a program to compute binomial coefficient (Given N and R).
3. Read N numbers from the console and create a list. Develop a program to print mean, variance and standard deviation with suitable messages.
4. Read a multi-digit number (as chars) from the console. Develop a program to print the frequency of each digit with suitable message.
5. Develop a program to print 10 most frequently appearing words in a text file. [Hint: Use dictionary with distinct words and their frequency of occurrences. Sort the dictionary in the reverse order of frequency and display dictionary slice of first 10 items
6. Develop a program to sort the contents of a text file and write the sorted contents into a separate text file. [Hint: Use string methods strip(), len(), list methods sort(), append(), and file methods open(), readlines(), and write()].
7. Develop a program to backing Up a given Folder (Folder in a current working directory) into a ZIP File by using relevant modules and suitable methods.
8. Write a function named DivExp which takes TWO parameters a, b and returns a value c (c=a/b). Write suitable assertion for a>0 in function DivExp and raise an exception for when b=0. Develop a suitable program which reads two values from the console and calls a function DivExp.

9. Define a function which takes TWO objects representing complex numbers and returns new complex number with a addition of two complex numbers. Define a suitable class 'Complex' to represent the complex number. Develop a program to read N (N >=2) complex numbers and to compute the addition of N complex numbers.
10. Develop a program that uses class Student which prompts the user to enter marks in three subjects and calculates total marks, percentage and displays the score card details. [Hint: Use list to store the marks in three subjects and total marks. Use _init_() method to initialize name, USN and the lists to store marks and total, Use getMarks() method to read marks into the list, and display() method to display the score card details.

Suggested Learning Resources:
Textbooks:

1	Al Sweigart,**"Automate the Boring Stuff with Python",** 1st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/)(Chapters 1 to 18, except 12) for lambda functions use this link:https://www.learnbyexample.org/python-lambdafunction/
2	Allen B. Downey, **"Think Python: How to Think Like a Computer Scientist",** 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf (Chapters 13, 15, 16, 17, 18) (Download pdf/html files from the above link)

Web links and Video Lectures (e-Resources):

- https://www.learnbyexample.org/python/
- https://www.learnpython.org/=
- https://pythontutor.com/visualize.html#mode=edit

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

Quizzes for list, tuple, string dictionary slicing operations using below link https://github.com/sushantkhara/Data-Structures-And-Algorithms-with-Python/raw/main/Python%203%20_%20400%20exercises%20and%20solutions%20for%20beginners.pdf

Course Outcomes: At the end of the course, the student will be able to	
CO1	Demonstrate proficiency in handling loops and creation of functions.
CO2	Identify the methods to create and manipulate lists, tuples and dictionaries.
CO3	Develop programs for string processing and file organization
CO4	Interpret the concepts of Object-Oriented Programming as used in Python.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	2	2	-	2	-	3
CO2	2	2	-	-	-	-	-	-	2	2	-	2	-	3
CO3	2	2	-	-	-	-	-	-	2	2	-	2	-	3
CO4	2	2	-	-	-	-	-	-	2	2	-	2	-	3

High-3, Medium-2, Low-1

Course Title	Operational Amplifiers and Linear ICs	**Semester**	4
Course Code	EE273	**CIE**	50
Total No. of Contact Hours	30	**SEE**	50
No. of Contact Hours/week	2:0:0	**Total**	100
Credits	2	**Exam. Duration**	3 Hours
Teaching Dept	Electrical and Electronics Engineering		

Course Objective is to:

- To understand the basics of Linear ICs such as Op-amp, Regulator, Timer & PLL.
- To learn the designing of various circuits using linear ICs.
- To use these linear ICs for specific applications.
- To understand the concept and various types of converters.
- To use these ICs, in Hardware projects.

Module-1	**RBT Levels: L1, L2**	**Hours: 06**

Operational amplifiers: Introduction, Block diagram representation of a typical Op-amp, schematic symbol, characteristics of an Op-amp, ideal op-amp, equivalent circuit, ideal voltage transfer curve, open loop configuration, differential amplifier, inverting & non –inverting amplifier, Op-amp with negative feedback(excluding derivations).
General Linear Applications: A.C. amplifier, summing, scaling & averaging amplifier, inverting and non-inverting configuration, Instrumentation amplifier.

Module-2	**RBT Levels: L1, L2, L3**	**Hours: 06**

Active Filters: First & Second order high pass & low pass Butterworth filters. Band pass filters, all pass filters.
DC Voltage Regulators: voltage regulator basics, voltage follower regulator, adjustable output regulator, LM317 & LM337 Integrated circuits regulators.

Module-3	**RBT Levels: L1, L2, L3**	**Hours: 06**

Signal generators: Triangular / rectangular wave generator, phase shift oscillator, saw tooth oscillator.
Comparators & Converters: Basic comparator, zero crossing detector, inverting & non-inverting Schmitt trigger circuit, voltage to current converter with grounded load, current to voltage converter and basics of voltage to frequency and frequency to voltage converters.

Module-4	**RBT Levels: L1, L2, L3**	**Hours: 06**

Signal processing circuits: Precision half wave & full wave rectifiers

A/D & D/A Converters: Basics, R–2R D/A Converter, Integrated circuit 8-bit D/A, successive approximation ADC, linear ramp ADC

Module-5	**RBT Levels: L1, L2, L3**	**Hours: 06**

Phase Locked Loop (PLL): Basic PLL, components, performance factors.
Timer: Internal architecture of 555 timer, Mono stable multivibrators and applications.

Course Outcomes: At the end of the course the student will be able to	
CO1	Describe the characteristics of ideal and practical operational amplifier.
CO2	Design filters and signal generators using linear ICs.
CO3	Demonstrate the application of Linear ICs as comparators and rectifiers.
CO4	Use ICs in the electronic projects.

CO-PO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	-	-	-	-	-	-	2	2	2	3	3	-
CO2	2	3	-	2	-	-	-	-	2	2	2	3	3	-
CO3	2	3	-	2	-	-	-	-	2	2	2	3	3	-
CO4	2	3	-	2	-	-	-	-	2	2	2	3	3	-

High-3, Medium-2, Low-1

Course Title	Operating System	**Semester**	4
Course Code	EE274	**CIE**	50
Total No. of Contact Hours	30	**SEE**	50
No. of Contact Hours/week	2:0:0	**Total**	100
Credits	2	**Exam. Duration**	3 Hours
Teaching Dept	Electrical and Electronics Engineering		

Course Objective is to:

- Understand the services provided by an operating system.
- Explain how processes are synchronized and scheduled.
- Understand different approaches of memory management and virtual memory management. Describe the structure and organization of the file system
- Understand interprocess communication and deadlock situations.

Module-1	**RBT Levels: L1, L2**	**Hours: 06**
Introduction to Operating Systems: OS, Goals of an OS, Operation of an OS, Computational Structures, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time and distributed Operating Systems		
Module-2	**RBT Levels: L1, L2, L3**	**Hours: 06**
Process Management: OS View of Processes, PCB, Fundamental State Transitions of a process, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS and SRN, Preemptive Scheduling- RR and LCN, Scheduling in Unix and Scheduling in Linux		
Module-3	**RBT Levels: L1, L2, L3**	**Hours: 06**
Memory Management: Contiguous Memory allocation, Non-Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, VM handler, FIFO, LRU page replacement policies, Virtual memory in Unix and Linux.		
Module-4	**RBT Levels: L1, L2**	**Hours: 06**
File Systems: File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access		
Module-5	**RBT Levels: L1, L2**	**Hours: 06**
Message Passing and Deadlocks: Overview of Message Passing, Implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Handling deadlocks, Deadlock detection algorithm, Deadlock Prevention		

Suggested Learning Resources:
Textbooks:

Operating Systems − A concept based approach, by Dhamdhere, TMH, 2nd edition.

REFERENCEBOOKS:

1. Operating systems concepts, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th edition,2001.
2. Operating system−internals and design system, William Stalling, Pearson Education, 4th ed,2006.
3. Design of operating systems, Tannanbhaum, TMH, 2001.

Web links and Video Lectures (e-Resources):

- **https://archive.nptel.ac.in/courses/106/105/106105214/**
- **https://onlinecourses.nptel.ac.in/noc20_cs04/preview**
- **https://onlinecourses.nptel.ac.in/noc21_cs72/preview**
- **https://nptel.ac.in/courses/106106144**

Course Outcomes: At the end of the course, students will be able to:	
CO1	Explain the goals, structure, operation and types of operating systems.
CO2	Apply scheduling techniques to find performance factors
CO3	Explain organization of file systems and IOCS.
CO4	Apply suitable techniques for contiguous and non-contiguous memory allocation.
CO5	Describe message passing, deadlock detection and prevention methods.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	2	2	-	2	-	3
CO2	2	2	-	-	-	-	-	-	2	2	-	2	-	3
CO3	2	2	-	-	-	-	-	-	2	2	-	2	-	3
CO4	2	2	-	-	-	-	-	-	2	2	-	2	-	3
CO5	2	2	-	-	-	-	-	-	2	2	-	2	-	3

High-3, Medium-2, Low-1

Course Title	Biology for Engineers	**Semester**	4
Course Code	BG257	**CIE**	50
Total No. of Contact Hours	30	**SEE**	50
No. of Contact Hours/Week	2:0:0	**Total**	100
Credits	02	**Exam. Duration**	3 Hours
Teaching Dept.	Basic Sciences		

Course Objective: To enable students

- Acquire an understanding on basic modern biological concepts with an emphasis on how bioprocesses are analogous to engineering field, as a multidisciplinary field.
- Understand basic engineering principles imminently run physiological processes, particularly about engineering designs and solutions that are arrived citing body functional examples.
- Explain aspects that many bio-solutions could be foundational to design, develop better processes, products and useful to achieve quality of life.

Module-1	**RBT Levels: L1, L2**	**Hours: 06**
Biomimetics: Biology for Engineers, Body Fluid: Blood – Mechanics of heart, Blood pressure, Life molecules: Water, Carbohydrates, Proteins, Lipids and Nucleic acids, Biomimetics: Bio-processes- engineering analogies.		
Module-2	**RBT Levels: L1, L2**	**Hours: 06**
Bioenergy: Unit of life: Human and Plant cell, Metabolism: Enzymes as Bio-catalysts and physiological entities, Anabolism – Bioenergy from Sun-Photosynthesis, catabolism.		
Module-3	**RBT Levels: L1, L2**	**Hours: 06**
Biomechanics (Human body Movement Mechanics) Normal Human Movement: Force-vector of body; Movement Angles; Muscle contraction-relaxation; Posture – Static & Dynamic; Ideal and abnormal posture, Practical: Stepping- Lifting- Sit-Stand.		
Module-4	**RBT Levels: L1, L2**	**Hours: 06**
Bioelectronics Brain & Computer: Senso-neural networks, Biosensors and IoT as applied to biology, Bionic Eye: Mechanism of Vision, Electronic Nose: Bio-olfactory mechanisms (Science of smell), Impulses: Cardiac and Nerve, Biological Clock and Circadian rhythm.		
Module-5	**RBT Levels: L1, L2, L3**	**Hours: 06**
Biopharma: Metabolic syndromes, Cancer and its diagnostics, Lab on a chip, Drug Discovery		

Suggested Learning Resources: **Textbooks:**	
1	Campbell, N.A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S.A.; Minorsky, P.V.; Jackson, R. B. Pearson. "Biology: A global approach", Global Edition, 10/E, 2014
2	David Nelson, Michael Cox. "Lehniger Principles of Biochemistry". W H Freeman & Company, 7th Edition, 2017.
Reference Books:	
1	Janine M Benvus. "Biomimicry: Innovation Inspired by Nature", William Morrow Paperbacks, 2002.

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

1. Real-world problem-solving and puzzles using group discussion.
2. Demonstration of solution to a problem through experiential learning.
3. Demonstration using real objects taking students on an educational tour.

Course Outcomes: At the completion of the course. The student shall be able to	
CO1	Apply and utilize essential knowledge of the biological mechanisms of living organisms from the perspective of engineers and find solutions to solve bio-engineering problems with appropriate tools.
CO2	Distinguish and make use of optimal designs in engineering that are bio-mechanical in nature and build and use by observing and understanding bio-physiological processes involved in sensing, locomotion, and knowledge application of range of bio-chemicals.
CO3	Demonstrate that bio-chemical, bio-sensory, bioprocesses could be path-finders to optimise similarities for functional aspects of electronic, computer, mechanical, electrical machines.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	-	-	1	-	-	-	-	1
CO2	3	1	1	-	-	-	1	-	-	-	-	1
CO3	3	1	1	-	-	-	1	-	-	-	-	1
CO4	3	1	1	-	-	-	1	-	-	-	-	1
CO5	3	1	1	-	-	-	1	-	1	-	-	1

High-3, Medium-2, Low-1

Course Title	NSS - Phase 2	**Semester**	4
Course Code	NS258	**CIE**	50
Total No. of Contact Hours	25	**SEE**	0
No. of Contact Hours/week	0:2:0	**Total**	50
Credits	-----	**Exam. Duration**	-----
Teaching Dept.	NSS		

Course Objective is to: National Service Scheme (NSS) will enable the students to:

- Understand the community in which they work.
- Identify the needs and problems of the community and involve them in problem-solving.
- Develop among themselves a sense of social and civic responsibility and utilize their knowledge in finding practical solutions to individual and community problems.
- Develop competence required for group-living and sharing of responsibilities and gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
- Develop capacity to meet emergencies and natural disasters and practice national integration and social harmony.

Module-1	**RBT Level/s: L1, L2**	**Hours: 04**

Organic farming
Indian Agriculture (Past, Present and Future) Connectivity for marketing. Waste management– Public, Private and Govt organization, 5 R's.Plantation and adoption of plants. Know your plants. Awareness on Organic farming

Module-2	**RBT Level/s: L1, L2**	**Hours: 03**

Developing Water conservation techniques
To develop a sustainable water management system, – Role of different stakeholders– Implementation. Developing a Sustainable Water management system for rural areas and implementation approaches.

Module-3	**RBT Level/s: L1, L2**	**Hours: 08**

Activity Based Programmes:
A. Campus Activities: Celebration of national importance days.

Awareness Programmes
Preparing an actionable business proposal for enhancing the village income and approach for implementation. Importance of health, hygiene, and sanitation Healthy lifestyle, HIV /AIDS, drugs and substance

Module-4	**RBT Level/s: L1, L2**	**Hours: 10**

Off Campus Activities:
Govt. school Rejuvenation and helping them to achieve good infrastructure and results, Women Empowerment Programme, Health Camps, Blood grouping awareness and Blood donation, Legal awareness Programme, Literacy Programme, Water Conservation Programme, One Day Special Camp in a village (preferably in the adopted village).

Course Outcomes: At the completion of the course. The student shall be able to	
CO1	Describe the concept of Youth and compare the international definitions of the term Youth.
CO2	Students will be able to appreciate our demographic advantage and its role in nation building.
CO3	Know the growth and evolution of NSS and its role in Nation building through community service
CO4	Visualize the signs, symbols, logo of NSS and understand their broader meaning.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	1	-	-	-	-	1
CO2	-	-	-	-	-	1	1	-	-	-	-	1
CO3	-	-	-	-	-	1	1	-	-	-	-	1
CO4	-	-	-	-	-	1	1	-	-	-	-	1

High-3, Medium-2, Low-1

Course Title	Physical Education (PE) (Sports and Athletics) – Phase 2	**Semester**	4
Course Code	PE258	**CIE**	50
Total No. of Contact Hours	25	**SEE**	0
No. of Contact Hours/Week	0:2:0	**Total**	50
Credits	--	**Exam. Duration**	------
Teaching Dept	PED		

Course Objective:

Physical education aims to develop all aspects of the human personality through physical and sports activities. Being a subject of science, it has its own value in society and human life. Physical Education is a form of one of the most effective means of education imparted through exercises, fun activities and sports. It is an integral part of the education system. It caters to the need for development of the students on physical, mental and social aspects

Module – 1	**RBT Levels: L1, L2**	**Hours: 05**

Ethics and Moral Values:

A. Ethics in Sports.
B. Moral Values in Sports and Games

Module – 2	**RBT Levels: L1, L2**	**Hours: 15**

Specific Games (Anyone to be selected by the student)

A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower Hand Pass.
B. Throw ball – Service, Receive, Spin attack, Net Drop & Jump throw.
C. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
D. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 up.
E. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & BackHand) Smash.
F. Athletics (Track / Field Events) – Any event as per availability of Ground.

Module - 3	**RBT Levels: L1, L2**	**Hours: 05**

Role of Organization and Administration

Course Outcomes: At the end of the course, the student will be able to	
CO1	Understand the ethics and moral values in sports and athletics.
CO2	Perform in the selected sports or athletics of student's choice.
CO3	Understand the roles and responsibilities of organization and administrationof sports and games.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	-	-	1	1	-	-	-	-	1
CO2	-	-	1	-	-	1	1	-	-	-	-	1
CO3	-	-	1	-	-	1	1	-	-	-	-	1

High-3, Medium-2, Low-1

Course Title	Yoga for a Better Life - Phase 2	**Semester**	4
Course Code	YG258	**CIE**	50
Total No. of Contact Hours	25	**SEE**	0
No. of Contact Hours/week	0:2:0	**Total**	50
Credits	---	**Exam. Duration**	-----
Teaching Dept	YOGA		

Course Objectives:

- To enable the student to have good health.
- To practice mental hygiene.
- To possess emotional stability.
- To integrate moral values.
- To attain higher level of consciousness.

Semester - 4	**RBT Levels: L1, L2**	**Hours: 25**

Patanjali's Ashtanga Yoga, its need and importance. Yama: Ahimsa, satya, asteya, brahmacarya, aparigraha Niyama :shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan.

Suryanamaskar12 count- 4 rounds of practice

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana Different types of Asanas

a. Sitting

1. Sukhasana
2. Paschimottanasana

b. Standing

1. Ardhakati Chakrasana
2. Parshva Chakrasana

c. Prone line

1. Dhanurasana

d. Supine line

1. Halasana
2. Karna Peedasana

Meaning, importance and benefits of Kapalabhati. 40 strokes/min 3 rounds Meaning, Need, importance of Pranayama.

Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama Pranayama –

1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana 4. Chandra Bhedana 5. Nadishodhana

Suggested Learning Resources:

Textbooks:

1. Yogapravesha in Kannada by Ajitkumar
2. Light on Yoga by BKS Iyengar
3. Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly
4. Yoga Instructor Course hand book published by SVYASA University, Bengaluru
5. Yoga for Children –step by step – by Yamini Muthanna

Web links and Video Lectures (e-Resources):
Refer links

- **https://youtu.be/KB-TYlgd1wE**
- **https://youtu.be/aa-TG0Wg1Ls**

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as;

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse). If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- **Physical**
  1. Improved body flexibility and balance
  2. Improved cardiovascular endurance (stronger heart)
  3. Improved digestion
  4. Improved abdominal strength
  5. Enhanced overall muscular strength
  6. Relaxation of muscular strains
  7. Weight control
  8. Increased energy levels
  9. Enhanced immune system
- **Mental**
  1. Relief of stress resulting from the control of emotions
  2. Prevention and relief from stress-related disorders
  3. Intellectual enhancement, leading to improved decision-making skills
- **Spiritual**
  1. Life with meaning, purpose, and direction
  2. Inner peace and tranquility
  3. Contentment

Course Outcomes: At the completion of the course. The student shall be able to	
CO1	Understand the meaning, aim and objectives of Yoga.
CO2	Perform Suryanamaskar and able to Teach its benefits.
CO3	Understand and teach different types of Pranayama, Asanas by name, its importance, methods and benefits.
CO4	Instruct Kapalabhati and its need and importance.
CO5	Coach different types of Kriyas , method to follow and usefulness.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	-	-	1	1	-	-	-	-	1
CO2	-	-	1	-	-	1	1	-	-	-	-	1
CO3	-	-	1	-	-	1	1	-	-	-	-	1
CO4	-	-	1	-	-	1	1	-	-	-	-	1
CO5	-	-	1	-	-	1	1	-	-	-	-	1

High-3, Medium-2, Low-1

Course Title	Social Connect and Responsibilities	**Semester**	IV
Course Code	SC259	**CIE**	50
Total No. of Contact Hours	25	**SEE**	0
No. of Contact Hours/week	0:0:2	**Total**	50
Credits	0	**Exam. Duration**	-----
Teaching Dept	Any Department		

Course objectives:

- Provide a formal platform for students to communicate and connect to the surrounding.
- Create a responsible connection with the society.
- Understand the community in general in which they work.
- Identify the needs and problems of the community and involve them in problem –solving.
- Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
- Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

General Instructions - Pedagogy :

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

SEMESTER IV	**RBT Level/s :L1, L2,L3**	**25 Hours**

Part I:

Plantation and adoption of a tree:

Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes.

Part II :

Heritage walk and crafts corner:

Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives, Visit, case study, report, outcomes.

Part III :

Organic farming and waste management:

Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes.

Part IV:

Water conservation:

Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices – Objectives, Visit, case study, report, outcomes.

Part V :

Food walk:

City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes

Activities:

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY:

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

Course outcomes: **At the completion of the course. The student shall be able to**	
CO1	Communicate and connect to the surrounding.
CO2	Create a responsible connection with the society.
CO3	Involve in the community in general in which they work.
CO4	Notice the needs and problems of the community and involve them in problem –solving.
CO5	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CO6	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

Duration:

A total of 40 - 50 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. Program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic and poetry) Faculty mentors have to design the evaluation system as per VTU guidelines of scheme & syllabus.

Pedagogy – Guidelines :

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	**Plantation and adoption of a tree:**	May be individual or team	Farmers land/ parks / Villages / roadside/ community area / College campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
2.	**Heritage walk and crafts corner:**	May be individual or team	Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
3.	**Organic farming and waste management:**	May be individual or team	Farmers land / parks / Villages visits / Roadside/ community area / College campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
4.	**Water conservation: & conservation techniques**	May be individual or team	Villages/ City Areas / Grama Panchayat/ public associations/Government Schemes officers / campus etc…..	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
5.	**Food walk: Practices in society**	May be individual or team	Villages/ City Areas / Grama Panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty

Plan of Action (Execution of Activities)	
Sl.NO	Practice Session Description
1	Lecture session in field to start activities
2	Students Presentation on Ideas
3	Commencement of activity and its progress
4	Execution of Activity
5	Execution of Activity
6	Execution of Activity
7	Execution of Activity
8	Case study based Assessment, Individual performance
9	Sector/ Team wise study and its consolidation
10	Video based seminar for 10 minutes by each student At the end of semester with Report.

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**
Field Visit, Plan, Discussion	10 Marks
Commencement of activities and its progress Case study based Assessment	20 Marks
Individual performance with report	20 Marks
Sector wise study & its consolidation 5*5 = 25	25 Marks
Total marks for the course	100 Marks

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.
- Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general through activities.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			1			1	1					1
CO2			1			1	1					1
CO3			1			1	1					1
CO4			1			1	1					1
CO5			1			1	1					1

High-3, Medium-2, Low-1