SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMAKURU

(An autonomous institution affiliated to VTU, Belagavi, Approved by AICTE, New Delhi, Accredited by NAAC with 'A' grade & ISO 9001:2015 Certified)

B.E. in Electrical and Electronics Engineering

SCHEME OF TEACHING AND EXAMINATION (2023 Scheme) (w.e.f. 2024-25)

III Semester

Sl. No.	Course and Course Code		Course Title	Teaching / Paper setting Dept.	Teaching hrs./week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Self-Study Component	Duration in hrs.	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1.	PCC / BSC	S3EE01	Transform Techniques in Electrical Engineering	EEE	3	0	0	3.5	3	50	50	100	3
2.	IPCC	S3CESI01	Digital Electronic Circuits with Verilog (Integrated)-(Common)	EEE/EIE	3	0	2	3.5	3	50	50	100	4
3.	PCC	S3CES02	Analog Electronic Circuits-(Common)	EEE/ETE	3	0	0	3.5	3	50	50	100	3
4.	IPCC	S3EEI03	Electric Circuit Analysis (Integrated)	EEE	3	0	2	3.5	3	50	50	100	4
5.	PCCL	S3EEL01	Analog Electronic Circuits Laboratory	EEE	0	0	2	-	3	50	50	100	1
6.	ESC	S3EESCXX	ESC/ETC/PLC	EEE	3	0	0	3.5	3	50	50	100	3
7.	UHV	SHSXX	Social Connect and Responsibility **(Board: ME)**	Dept.	0	0	2	-	-	100	-	100	1
8.	AEC/ SEC	S3EEA01 S3EEA02 S3EEA03 S3EEA04	Introduction to Solar Photovoltaics Electrical Hardware Laboratory Python programming Fuzzy logic control Laboratory	EEE	If offered as Theory Course 1	0	0		1½	50	50	100	1
					If offered as Integrated Course 0	0	2		1½				
9.	NCMC	SMC01	National Service Scheme (NSS)	NSS CO	0	0	2			100	-	100	0
		SMC02	Physical Education (PE) (Sports and Athletics)	PED									
		SMC04	Yoga	PED									
			Total							**550**	**350**	**900**	**20**
		AAP	AICTE Activity Points (Applicable for both Regular and Lateral Entry students)	40 hours community service to be documented and produced for the examination									

Note: **PCC**: Professional Core Course, **IPCC**: Integrated Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **NCMC**: Non Credit Mandatory Course, **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **ESC**: Engineering Science Course, **ETC**: Emerging Technology Course, **PLC**: Programming Language Course
L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Engineering Science Course (ESC/ETC/PLC) (Offered by the Department)

S3EESC01	Electrical Power Generation and Economics	S3EESC03	Computer organization
S3EESC02	OOPS with C++	S3EESC04	Semiconductor Devices

Ability Enhancement Course – III (Offered by the Department)

S3EEA01	Introduction of Solar Photovoltaic and Wind Energy System (Integrated)	S3EEA02	Electrical Hardware Laboratory
S3EEA03	Python programming	S3EEA04	Fuzzy logic control Laboratory

Integrated Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L: T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering (B.E.) 2022-23 may please be referred.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

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IV Semester

Sl. No.	Course and Course Code		Course Title	Teaching / Paper setting Dept.	Teaching hrs./week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Self-Study Component	Duration in hrs.	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1.	PCC	S4EE03	Electrical Machines-I	EEE	3	0	0	3.5	3	50	50	100	3
2.	IPCC	S4CESI01	Control Systems (Integrated)-(Common)	EEE	3	0	2	3.5	3	50	50	100	4
3.	IPCC	S4CESI02	ARM Microcontroller (Integrated)-(Common)	EEE	3	0	2	3.5	3	50	50	100	4
4.	PCCL	S4EEL01	Electrical Machines-I Laboratory	EEE	0	0	2	-	3	50	50	100	1
5.	ESC	S3EESCXX	ESC/ETC/PLC	EEE	3	0	0	3.5	3	50	50	100	3
6.	BSC	S4CCA01	Biology for Engineers **(Board: BT)**	BT, CH, Phy, Che	3	0	0	3.5	3	50	50	100	3
7.	UHV	SHSXX	Universal Human Values Course **(Board: IEM)**	Dept.	1	0	0	-	1½	50	50	100	1
8.	AEC/ SEC		Ability Enhancement Course/ Skill Enhancement Course – IV	Dept.	If offered as Theory Course: 1	0	0		1½	50	50	100	1
					If offered as Integrated Course: 0	0	2		1½				
9.	NCMC	NS	National Service Scheme (NSS)	NSS CO	0	0	2			100	-	100	0
		PE	Physical Education (PE) (Sports and Athletics)	PED									
		YO	Yoga	PED									
			Total							**500**	**400**	**900**	**20**
		AAP	AICTE Activity Points (Applicable for both Regular and Lateral Entry students)	40 hours community service to be documented and produced for the examination									

Note: **PCC**: Professional Core Course, **IPCC**: Integrated Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **NCMC**: Non Credit Mandatory Course, **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **ESC**: Engineering Science Course, **ETC**: Emerging Technology Course, **PLC**: Programming Language Course
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Engineering Science Course (ESC/ETC/PLC) (Offered by the Department)

S4EESC01	Engineering Materials	S4EESC03	Digital Signal Processing
S4EESC02	Basic VLSI Design	S4EESC04	Linear Integrated Circuits and Applications

Ability Enhancement Course – IV (Offered by the Department)

S4EEA01	Simulation of electronic circuits using SPICE	S4EEA03	Web Technology Laboratory
S4EEA02	IC's and PLC Automation Laboratory	S4EEA04	DBMS laboratory

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VISION of the Institute

To develop thoughtful and creative young minds in a learning environment of high academic ambience by synergising spiritual values and technological competence.

MISSION of the Institute

1. To continuously strive for the total development of students by educating them in state-of-the-art-technologies and managerial competencies providing best in class learning experience with emphasis on skills, values and learning outcomes and helping them imbibe professional ethics and societal commitment.
2. To create research ambience that promotes interdisciplinary research catering to the needs of industry and society.
3. To collaborate with premier academic and research institutions and industries to strengthen multidisciplinary education, applied research, innovation, entrepreneurship and consulting ecosystems.

VISION of the Department:

To be the premier center for education and research in Electrical and Electronics Engineering and to produce globally competent engineers with ethical values.

MISSION of the Department:

- Develop as a center of Excellence for Electrical and Electronics Engineering education by providing the state-of –the-art infrastructure, industry relevant curriculum and effective teaching learning process.
- Contribute to the development of nation by pursuing research and development in the thrust areas of Electrical and Electronics Engineering such as Power Systems, Electrical Machines, Power Electronics and Renewable Energy Systems.
- Enable graduates to be professionally competent with strong ethical values.

PROGRAM EDUCTAIONAL OBJECTIVES (PEOs)

1. Pursuing successful career in the Electrical and Electronics Engineering and allied fields and opt for higher studies, research and to be an entrepreneur.
2. Designing solutions to Power System Engineering, Electrical Machines, Power Electronics and Renewable Energy Systems for specific industry applications and real-life problems using broad engineering knowledge.
3. Demonstrating professionalism, Ethical behavior and lifelong learning.

SCHEME & SYLLABUS
OF
III & IV SEMESTERS
B.E. ELECTRICAL & ELECTRONICS ENGINEERING
2024-25

(A) PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
13. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(B) PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Analyze, Design and Assess the performance of Electrical Power System and its constituent equipment
2. Analyze, Design and Develop Power Electronic Systems.

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6.	ESC	S3EESCXX	ESC/ETC/PLC	EEE	3	0	0	3.5	3	50	50	100	3
7.	UHV	SHSXX	Social Connect and Responsibility **(Board: ME)**	Dept.	0	0	2	-	-	100	-	100	1
8.	AEC/ SEC	S3EEA01 S3EEA02 S3EEA03 S3EEA04	Introduction to Solar Photovoltaics Electrical Hardware Laboratory Python programming Fuzzy logic control Laboratory	EEE	If offered as Theory Course 1	0	0		1½	50	50	100	1
					If offered as Integrated Course 0	0	2		1½				
9.	NCMC	SMC01	National Service Scheme (NSS)	NSS CO	0	0	2			100	-	100	0
		SMC02	Physical Education (PE) (Sports and Athletics)	PED									
		SMC04	Yoga	PED									
			Total							**550**	**350**	**900**	**20**
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3.	IPCC	S4CESI02	ARM Microcontroller (Integrated)-(Common)	EEE	3	0	2	3.5	3	50	50	100	4
4.	PCCL	S4EEL01	Electrical Machines-I Laboratory	EEE	0	0	2	-	3	50	50	100	1
5.	ESC	S3EESCXX	ESC/ETC/PLC	EEE	3	0	0	3.5	3	50	50	100	3
6.	BSC	S4CCA01	Biology for Engineers **(Board: BT)**	BT, CH, Phy, Che	3	0	0	3.5	3	50	50	100	3
7.	UHV	SHSXX	Universal Human Values Course **(Board: IEM)**	Dept.	1	0	0	-	1½	50	50	100	1
8.	AEC/ SEC		Ability Enhancement Course/ Skill Enhancement Course – IV	Dept.	If offered as Theory Course: 1	0	0		1½	50	50	100	1
					If offered as Integrated Course: 0	0	2		1½				
9.	NCMC	NS	National Service Scheme (NSS)	NSS CO	0	0	2			100	-	100	0
		PE	Physical Education (PE) (Sports and Athletics)	PED									
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Ability Enhancement Course – IV (Offered by the Department)			
S4EEA01	Simulation of electronic circuits using SPICE	S4EEA03	Web Technology Laboratory
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Transform Techniques in Electrical Engineering

Contact Hours/Week	:	3 (L)	Credits	:	3
Total Lecture Hours	:	42	CIE Marks	:	50
Total Tutorial Hours	:	0	SEE Marks	:	50
Course Code	:	S3EE04			

Course Objectives: This course will enable students to:

1. Understand the fundamental characteristics of signals and systems.
2. Develop the mathematical skills to solve problems involving convolution, filtering, modulation and sampling

Unit I

Introduction: Definition of signals and systems, Mathematical Representation, Classification of signals, Operation on signals, Elementary signals, Systems viewed as interconnection of operations, Properties of systems

8Hrs

Unit II

Time Domain Representation of LTI Systems: Introduction, impulse response representation of LTI systems, Properties of impulse response representation, difference equation representation of LTI systems.

8Hrs

Unit III

Fourier Transforms of signals and its application: Introduction, Discrete Time non periodic signals: DTFT representation, Continuous Time non periodic signals: FT representation, Properties of Fourier transforms and DTFT. Introduction, Frequency response of LTI systems, Fourier Transform representation of periodic signals, Fourier Transform representation of Discrete time signals, Sampling, reconstruction of continuous time signals.

9Hrs

Unit IV

Z-Transform: Introduction, Properties of ROC, Properties of Z-transform, inversion of Z-transform, Transform analysis of LTI systems, stability & causality, Unilateral Z-transform and its application

8Hrs

Unit V

Laplace Transform: Wave form synthesis- Determination of Laplace Transform of different types of wave forms using unit step, ramp and other signals**, Solution** of networks with DC and AC excitation, Application of Fourier series to the circuits applied with non- sinusoidal signals.

9Hrs

Text books:

1.	Simon Haykin.	Signals and Systems. 2nd Edition. John Wiley 2002. ISBN-10 8126512652 ISBN-13 978-8126512652
2.	J. G. Proakis and D. G. Manolakis	Digital Signal Processing: Principles, Algorithms and Applications, 4th Edition, PHI, 2007. ISBN-10 9788131710005

Reference books:

1.	Schaum Series.	Signals and Systems. McGraw-Hill; 1 edition,1995
2.	Oppenheim and Willsky.	Signals and Systems. Pearson India; 2nd edition,2015

Course Outcomes: After the completion of this course, students will be able to:

1. **Outline** the properties and analyze continuous time and Discrete time signals and systems.
2. **Analyze** the time domain representation of LTI Systems.
3. **Apply** and **Analyze** Fourier analysis tools like FT and DTFT to continuous time and discrete time signals.
4. **Apply** Z-Transform to time domain signals.
5. **Apply** the technique of Laplace transform to analyze both DC and AC circuits.
6. **Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)**

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

Digital electronic circuits with Verilog

Contact Hours/ Week	: 3:0:2 (L+T+P)	Credits:	4
Total Lecture Hours	:40	CIE Marks:	50
Total Tutorial Hours	:0	SEE Marks:	50
Total Practical Hours	:26	Course Code:	**S3CESI01**

Course objectives: This course will enable students to:	
1.	Study properties of basic gates and simplifications of Boolean expressions and Analyse combinational & sequential circuits with design examples, functionality of various memory devices.
2.	Describe Verilog data types with operators and develop Verilog codes for digital blocks in different modelling.

Unit I

Properties of Logic Gates: Noise Margin, Fan-out, Propagation Delay, Power Dissipation. Voltage and current parameters.

Simplification of Boolean Expressions: Canonical forms, Karnaugh maps (3 and 4 variable)**Introduction to Verilog HDL:** HDL basic concepts: Syntax & semantics, Data types, Operators, HDL modelling types, Developing HDL code for Logic Circuits using HDL program.

8 Hrs

Unit II

Combinational Logic Circuits: Binary adders and subtracters, carry look-ahead adder, Decimal adders, Comparators- one bit and two bit, Decoders, Encoder, Multiplexer, Logic design using decoders and multiplexers. Modelling combinational logic circuits using dataflow, gate level and behavioral Verilog HDL program.
Self-study component: Decoder with 7-segment display, Parallel to serial conversion using MUX

8 Hrs

Unit III

Sequential Circuits: Basic bi-stable element, Latches- SR Latch using NAND gates, D Latch, Gated D Latch, Flip-flops – SR, D, JK and T, Characteristic equations, Flip flop conversions Registers: shift register- SISO, SIPO, PISO, Universal shift register, Counters: asynchronous and MOD counter, ring Counter and Johnson counter, modeling sequential circuits using behavioral Verilog HDL program
Self-study component: Tasks in Verilog HDL

8 Hrs

Unit IV

Sequential Design: Introduction, Synchronous counter design, Mealy and Moore Models, Sequential circuit design using Mealy Model, Synchronous Sequential Circuit Analysis.
Self-study component: Develop Verilog code for sequence detector using Mealy model.

8 Hrs

Unit V

Memory Devices: Memory types and terminology- Memory organization and operation, Memory reading and writing, RAMs, ROMs and PROMs. Read Only Memory-ROM organization, Rom timing, types of ROMs, Applications of ROMs, Semiconductor RAMs-Static RAMs, Dynamic RAMs, ROMs, Read-Write cycle of ROM and RAM.
Self-study component: Programmable logic Devices- PAL, PLA, PROM.

8 Hrs

TEXT BOOKS

1	Donald D. Givone	Digital Principles and Design, TATA McGraw-hill Edition 2017
2	A.Anand Kumar	Fundamentals of Digital circuits, PHI; 4th edition 2016
3	Samir Palnitkar	"Verilog HDL A guide to Digital Design and Synthesis" Second Edition, Pearson Education ,2003

REFERENCE BOOKS

1	Ronald J Tocci, Neal S Widmer and Regory L Moss.	Digital Systems Principles and Applications, 12th Edition, Pearson, 2017.
2	Charles H. Roth. Jr.	Digital Systems Design using Verilog, Thomson Learning, Inc, 1st edition 2015.
3	R D Sudhakar Samuel	Logic Design, Sanguine technical Publishers,2004

Integrated Lab

DIGITAL ELECTRONIC CIRCUITS LAB (Only for CIE) **(2 Hours per week per batch) 10 lab sessions + 1 Lab assessment**	
Sl.	**Experiments**

No.	
Part-A Hardware Experiments:	
1	Realization of Parallel Adder/ Subtractor
2	Multiplexer: Adder and Subtractor using MUX
3	Use of Decoder Chip to Drive Led Display
4	Realization of One Bit Magnitude Comparator
5	Design 3-bit up-counter using T-FF
Part-B Verilog Experiments	
6	Write Verilog code for full adder using i) Dataflow description ii) Gate-level description
7	Write Verilog code for 4:1 MUX using i) Dataflow description ii) Gate-level description iii) Behavioral Description
8	Write Verilog code for 2:4 decoder using i) Dataflow description ii) Gate-level description iii) Behavioral Description
9	Write Verilog code for D FF, JK FF, T FF using Behavioral description
10	Write Verilog code for up/down counter

Course Outcomes: After the completion of the course, students will be able to:

CO1	**Apply** the knowledge of K Maps for simplification of Boolean expressions and develop Verilog code for logic circuits.
CO2	**Design** combinational circuits and develop dataflow, gate level and behavioral Verilog code.
CO3	**Implement** shift registers and asynchronous counters by selecting Flip Flops and develop behavioral Verilog code.
CO4	**Analyze** and design synchronous sequential circuits and develop behavioral Verilog code.
CO5	**Analyze** different memories and design logic circuits using programmable logic devices.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

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

Analog electronic circuits

Contact Hours/Week	: 3:0:0(L+T+P)	Credits:3
Total Lecture Hours	: 42	CIE Marks:50
Sub. Code	: S3CES02	SEE Marks:50

Course objectives: This course will enable students to

1. Design and analysis of MOSFET device, Differential amplifiers and concepts of Power amplifiers.
2. Discuss the concept of Opamp as a black-box and design using Linear ICs, 555 timer, Data converters and PLL based circuits.

Unit I

Working Principle of MOS capacitor and MOSFET (2 hr), I-V characteristics of MOSFET, Small signal models (2hrs), Biasing of MOSFET amplifiers, Design of Common Source amplifier (3hrs), (Text book 1)

9Hrs

Unit II

High frequency model, Miller's Theorem, frequency response of CS amplifier (2hrs). CG and CD (Text book 1), Cascode amplifiers (3hrs), Current mirrors, amplifiers with active loads (2 hrs) (Text book 2)

8Hrs

Unit III

The MOS differential pair and their small signal operation (3 hrs) Differential amplifiers with active load (3 hrs). Power amplifiers: Classification, Class A, B, AB and class C power amplifiers. (3 hrs) (Text book 2)

9Hrs

Unit IV

OPAMP: Opamp as a black box, Various applications of op-amps like inverting and non-inverting amplifiers and error analysis due to offset voltage and currents, voltage follower, Comparator, Zero-crossing detector, summing and difference amplifier (2 hrs), Integrators, differentiators, Instrumentation amplifier (2 hrs) (Text book 1), Square wave generator, Schmitt trigger, Precision rectifier (3 hrs) (Text book 2).

7Hrs

Unit V

Linear ICs: 555 timer IC and its application Astable, Mono stable MV (2 hrs) (Text book 2). PLL 565 IC (1 hr), DAC: basics, binary weighted R-DAC and R-2R DAC (3hrs), ADC: DAC based ADC, Successive approximation ADC, Flash ADC (3 hrs) (Text book 3)

9Hrs

Text Books:

1.	*Behzad Razavi "Fundamentals of Microelectronics", 2nd Edition,2021, Wiley,* ISBN-*10 1119695147*
2.	*Adel S. Sedra, Kenneth Carless Smith, "Microelectronic Circuits", Oxford University. 6th Edition. 2014, ISBN-10 0195323033*
3.	Sergio Franco, Design with Operational amplifiers and Analog Integrated

	circuits, Third Edition, Mc Graw Hill, ISBN-10 0070530440

Note: 3 text books due to wide variety of topics, Normal font in the syllabus means text book 1, *Italic* is text book 2 and underlined is text book 3.

Course Outcomes: After the completion of this course, students will be able to:

CO1	**Explain** the MOSFET structure, its working, small signal model
CO2	**Design** and analyze CS, CG, CD and Differential amplifiers
CO3	**Discuss** the need of Power amplifiers and design Class A, Class B power amplifiers.
CO4	**Design** Opamp based amplifies, Schmitt triggers, generators, and rectifiers.
CO5	**Design** of circuits using Timer, PLL, ADC and DAC ICs.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

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

Electric circuit analysis

Contact Hours/ Week	: 3:0:2 (L+T+P)	Credits:	4.0
Total Lecture Hours	: 42	CIE Marks:	50
Total Practical Hours	: 26	SEE Marks:	50
Course Code	: **S3EEI03**		

Course objectives: This course will enable students to

1. Analyze and solve DC&AC circuits using loop, node analysis and theorems.
2. Solve first and second order differential equations to obtain steady state and transient response in series & parallel RLC circuits.
3. Analysis of balanced and unbalanced three phase circuits, mutually coupled circuits and two port networks.

Unit I

Basic Circuit Concepts: Active and passive elements, Concept of ideal and practical sources. Network reduction of resistive circuits by source transformation and star–delta transformation techniques. Loop and node analysis with linearly dependent and independent sources for DC and AC circuits.

8 Hrs

Unit II

Network Theorems: Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Millman's theorem. Concept of duality and dual networks.

8 Hrs

Unit III

Transient Analysis: Evaluation of initial and final conditions in network elements, Transient

analysis of series R-L, R-C and R-L-C circuits under both DC and AC excitations.

9 Hrs

Unit IV

Resonance in RLC circuits: Series resonance, parallel resonance, Resonance curve, Q-factor and Bandwidth in series and parallel resonance circuits. **Three-phase circuits:** Analysis of balanced & unbalanced star and delta connected loads, Neutral shift. Measurement of active power, reactive power and power factor by two-watt meter method.

8 Hrs

Unit V

Coupled Circuits: Analysis of coupled circuits**,** Dot convention, conductively coupled equivalent circuits. **Two port networks:** Open circuit impedance, short circuit admittance and Transmission parameters and their evaluation for resistive networks.

9 Hrs

Text books:

1	Hayt Kemmerly and Durbin.	Engineering Circuit Analysis. 6th Edition. THM. 2002.
2	M E Van Valkenburg	Network Analysis. 3rd Edition, PHI. 2002.

Reference books:

1	Carlson A. Bruce	Circuits. Thomson learning. 2002.
2	Joseph Edminister & Nahvi M.	Theory and problems of Electric Circuits. Ed. 3. THM.

Integrated Lab

Sl. No.	Experiments
1	Verification of KCL and KVL
2	Verification of Thevenin's and Norton's theorem.
3	Verification of superposition theorem.
4	Verification of Maximum Power Transfer theorem.
5	Transient analysis of series RLC circuits.
6	Resonance characteristics of series R-L-C circuits.
7	Resonance characteristics of parallel R-L-C circuits.
8	Determination of Two-port parameters (Z, Y)
9	Determination of Two-port parameters (ABCD)
10	Measurement of power in a balanced 3-Phase Circuit using two wattmeter for star & delta connected loads.

Course Outcomes: After the completion of this course, students will be able to:

CO1	**Apply** the network reduction techniques to solve both DC and AC circuits using loop and nodal analysis.
CO2	**Apply** the network theorems to analyze both DC and AC circuits.
CO3	**Solve** the steady state and transient responses of series and parallel R-L, R-C, R-L-C circuits.
CO4	**Analyze** balanced and unbalanced star and delta connected circuits and resonance in series and parallel circuits.

CO5	**Analyze** the coupled circuits and two port networks.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

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

Analog Electronic Circuits Lab

Lab Hours/ Week	: 0:0:2(L+T+P)	Credits:	1.0
Course Code	: **S3EEL01**	CIE Marks:	50
		SEE Marks:	50

Course Objectives: Analyze to design, and test various electronic circuits based on semiconductor devices.

Sl. No.	Experiments
1	Full wave rectifier using bridge rectifier.
2	Full wave rectifier using center tapped transformer with and without C filters.
3	Design of power supply using bridge rectifier for specific load voltage & current and ripple factor.
4	Clipping circuits using diodes.
5	Clamping circuits using diodes.
6	Design of RC coupled single stage CE amplifier and determination of voltage gain, with and without by-pass capacitor.
7	Design of RC coupled single stage CE amplifier and determination of frequency response, input and output impedances.
8	Basic op-amp circuits. (Inverting, Non-inverting and Differential amplifier)
9	Precision rectifiers.
10	555 Timer as Monostable and Astable multivibrator

Course Outcomes: After the completion of this course, students will be able to:

CO1	Design regulated power supply for the given specifications.
CO2	Design test and analyse clipping & clamping circuits, and RC coupled amplifier.
CO3	Design and test multi-vibrators using 555 timers.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

		POs												PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
COs	CO1	3	3	3		2									3
	CO2	3	3			2									3
	CO3	3	3			2									3

Engineering Science Course

Electrical Power Generation and Economics

Contact Hours/Week	:	3 (L)	Credits	:	3.0
Total Lecture Hours	:	42	CIE Marks	:	50
Total Tutorial Hours	:	--	SEE Marks	:	50
Course Code	:	S3EESC01			

Course objectives: This course will enable students to

1. Understand the basics of hydroelectric power plant, merits and demerits of hydroelectric power plants, site selection, arrangement and elements of hydroelectric plant.
2. Understand importance of different equipment in substation and economics of power generation.

Unit I

Introduction, Potential of hydropower in India- its development and future prospect. General hydrology-hydrological cycle, precipitation, run-off and its measurement, hydrography, unit hydrograph, flow duration and mass curve. Design, construction and operation of different components: Dams, spillways, Canals, penstocks, surge tanks, draft tubes; Power – house structure, Selection of prime mover, speed and pressure regulation, methods of governing, starting and stopping of water turbines, operation of hydro turbines.

9 Hrs

Unit II

Carnot and Rankine Cycle with Re-heating and Re-generative Feed Heating. Types of Coal and their Characteristics, Coal Analysis, overall operation of boiler, thermal efficiency, operation of thermal power plant, gas cycle and gas turbine, combined cycle or co-generation, governing of steam turbines.

8 Hrs

Unit III

General Components of Nuclear Reactor, General Problems of Reactor Operation, Different Types of Reactors, Pressurized Water Reactors (PWR), Boiling Water Reactors (BWR), Heavy Water - cooled and Moderated CANDU (Canadian Deuterium Uranium) Type Reactors, Gas-cooled Reactors, Breeder Reactors, Reactor Containment Design.

8 Hrs

Unit IV

Solar Power Conversion systems: Introduction to non-conventional energy resources, Solar Photovoltaic (SPV) systems: Operating principle, Photovoltaic cell concepts, Types of solar cells, fabrication of SPV cells, Cell, module, array (Series and parallel connections), SPV system components and their characteristics, applications, Block diagram of general SPV system, Battery sizing and Array sizing, Batteries and Inverters. **Wind Energy Conversion System:** Introduction to wind energy, basic principles of wind energy conversion, Site selection considerations, power in the wind – maximum power, wind energy conversion, Basic components of wind energy conversion systems, classifications of WECS-HAWT, VAWT, Comparison/ advantages and disadvantages of WECS.

9 Hrs

Unit V

Energy Economic of Electrical Power system: Introduction. Terms commonly used in system

operation. plant capacity factor, plant use factor, plant utilization factor and loss factor, Cost of Electrical Energy, Expressions for Cost of Electrical Energy, Methods of Determining Depreciation, Importance of High Load Factor.

Tariff: Introduction to tariff, Desirable Characteristics of a Tariff, **Types of Tariffs:** Simple tariff, Flat rate tariff, Block rate tariff, Two-part tariff, Maximum demand tariff, Power factor tariff, Three-part tariff. **Power Factor Improvement:** Power Factor, Power Triangle, causes and consequences of Low Power Factor, Power Factor Improvement, Power Factor Improvement Equipment, calculations of Power Factor Correction, Most Economical Power Factor, Meeting the Increased kW Demand on Power Stations

8 Hrs

Text books:

1	V. K. Mehta, Rohit Mehta	"Principles of Power System "publisher: S. Chand, 2005, ISBN:9788121924962, 8121924960
2	Rakosha Das Begamudre	Energy conversion systems, New age International Publishers,2007, **ISBN**-8122412661, 9788122412666
3	P.K.Nag	Power Plant Engineering, Tata McGraw Hill Education, 2002, ISBN-**ISBN**: 9789339204044, 9789339204044
4	Solanki Chetan S	Renewable Energy Technologies, PHI Learning, 2008, **ISBN:** 9788120334342
5	Earnest, Joshua	Wind Power Technology, second edition, PHI Learning, 2013, **ISBN:** 9788120351271

Reference books:

1	A. Chakrabarti, M. L. Soni, and P.V. Gupta,	Power System Engineering, Dhanpat Rai and Co., New Delhi., 2008, **ISBN: 8177000209, 9788177000207**
2	N.S.Rathore and N.L.Panwar	Renewable Energy Sources for Sustainable Development, New India Publishing Agency,2007, **ISBN**: 9788189422721
3	Thomas Ackermann	Wind Power in Power System, John Willey & Sons,2012, **ISBN**: 978-0-470-97416-2

Course objectives: This course will enable students to:

CO 1. **Analyze** the principle of Energy conversion systems using various resources

CO 2. **Analyze** the Operation and control of various types of conventional Electrical Power Generating stations.

CO 3. **Analyze** the Conversion principles of Solar and Wind energy conversion systems.

CO 4. **Interpret** the economic aspects of power system operation and its effects.

CO 5. **Analyse** the Economical aspects of power generation and cost of energy.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

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

OOPS WITH C++

Contact Hours/Week	:	3 (L)	Credits	:	3.0
Total Lecture Hours	:	42	CIE Marks	:	50
Total Tutorial Hours	:	--	SEE Marks	:	50
Course Code	:	S3EESC02			

Course Objectives: This course will enable students to

1	Illustrate object-oriented programming capability to store information together in an object.
2	Understand the capability of a class to rely upon another class, functions, special type of functions.
3	Create and process data in files using file I/O functions.

Unit I

Introduction to Object Oriented Programming: Computer programming background- C++ overview. Object Oriented Programming: What is an object, Classes, methods and messages, abstraction and encapsulation, inheritance, abstract classes, polymorphism.

8 Hrs

Unit II

Functions in C++: Tokens – Keywords – Identifiers and constants – Operators in C++ – Scope resolution operator – Expressions and their types – Special assignment expressions – Function prototyping – Call by reference – Return by reference – Inline functions -Default arguments – Function overloading.

9 Hrs

Unit III

Inheritance & Polymorphism: Derived class Constructors, destructors-Types of Inheritance- Defining Derived classes, Single Inheritance, Multiple, Hierarchical Inheritance, Hybrid Inheritance.

8 Hrs

Unit IV

I/O Streams: C++ Class Hierarchy- File Stream-Text File Handling- Binary File Handling during file operations.

8 Hrs

Unit V

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Vector Processing, Array Processors. Data Dependencies, Handling Data Dependencies, Hardware Multithreading, Exception **Handling**: Introduction to Exception - Benefits of Exception handling- Try and catch block Throw statement- pre-defined exceptions in C++

9 Hrs

Text books:

1	Bhushan Trivedi,	"Programming with ANSI C++", Oxford Press, Second Edition, 2012.
2	Balagurusamy E,	Object Oriented Programming with C++, Tata McGraw Hill Education Pvt.Ltd ,

Reference books:

1	Bjarne Stroustrup,	The C++ Programming Language 2013. Or, Programming: Principles and Practice Using C++ 2014

2	Brian W. Kernighan and Dennis M. Ritchie	The C Programming Language (Ansi C Version) 1990.
3	Tutorial Link:	https://www.w3schools.com/cpp/cpp_intro.asp https://www.edx.org/course/introduction-to-c-3
4	NPTEL Link	https://onlinecourses.nptel.ac.in/noc21_cs02/preview

Course Outcomes: After the completion of this course, students will be able to:

CO1	**Design** solution to problems using object-oriented programming concepts.
CO2	**Apply** extensible Class types, User-defined operators and function overloading.
CO3	**Utilize** code reusability and extensibility by means of inheritance and polymorphism.
CO4	**Implement** the features of C++ for templates and exceptions.
CO5	**Implement** file handling for providing programmed solutions to complex problems.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

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

Computer organization

Lab Hours/ Week	: 3+0+0(L+T+P)	Credits:	3.0
Total Theory hours/Week	: 42	CIE Marks:	50
Total Practical hours/Week	: 00		
Sub. Code	: S3EESC03	SEE Marks:	100

Course Objectives: This course will enable students to:

1. Understand the basics of computer structure and operation and machine instructions.
2. Interpret different ways of communication with standard I/O devices interfaces.
3. Understand basic processing unit and concept of pipelining and large computing systems.

Unit- I

Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance–Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.
Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines.

8 Hrs

Unit-II

Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces - PCI Bus, SCSI Bus, USB.

8 Hrs

Unit-III

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories -Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage.

9 Hrs

Unit-IV

Arithmetic: Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations.

9 Hrs

Unit-V

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. **Embedded Systems and Large Computer Systems:** Examples of Embedded Systems, Processor chips for embedded applications, General-Purpose Microprocessor and Microcontroller.

8 Hrs

Textbooks:

1.	Carl Hamacher, Zvonko Vranesic, Safwat Zaky	Computer Organization, 5th Edition, Tata McGraw Hill, 2011, ISBN-10- 1259005275, ISBN-13- 978-1259005275
2.	David A. Patterson and John L. Hennessy	Computer Organization and Design: The Hardware/Software Interface, Pearson Education, 2013, , ISBN-10- 933251870XISBN-13- 978-9332518704.

Reference books:

1.	William Stallings:	Computer Organization & Architecture, 11th Edition, Pearson, 2022, ISBN-10-9356061599, ISBN-13-978-9356061590

Course outcomes: After studying this course, students will be able to:

CO1	**Interpret** the basic structure of computers & machine instructions and programs, Addressing Modes, Assembly Language, Stacks, Queues and Subroutines.
CO2	**Analyse** interrupt handling and multiple interrupts. Design multiple interrupt devices
CO3	**Design** and **Evaluate** performance of memory systems.
CO4	**Design** of fast adders to perform arithmetic addition and subtraction. Design fast adders to perform multiplication and division of integers and floating-point numbers.
CO5	**Analyse** the importance of Microprocessor, Microcontroller and embedded system

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

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

Semiconductor devices

Contact Hours/Week	:	3 (L)	Credits	:	3.0
Total Lecture Hours	:	42	CIE Marks	:	50
Total Tutorial Hours	:	--	SEE Marks	:	50
Course Code	:	S3EESC04			

Course Objectives: This course will enable students to

1 Understand the basics of semiconductor physics, electronic devices and mathematical models BJTs and FETs

2 Interpret the fabrication process of semiconductor devices and CMOS process integration.

Unit I

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. (Text 1: 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.2.1, 3.2.3, 3.2.4, 3.4.1, 3.4.2, 3.4.3, 3.4.5).

8 Hrs

Unit II

P-N Junctions Forward and Reverse biased junctions- Qualitative description of Current flow at a junction, reverse bias, Reverse bias breakdown, avalanche breakdown, Rectifiers. (Text 1: 5.3.1, 5.3.3, 5.4, 5.4.1, 5.4.2, 5.4.3) **Optoelectronic Devices Photodiodes:** Current and Voltage in an Illuminated Junction, Solar Cells, Photodetectors. **Light Emitting Diode:** Light Emitting materials. (Text 1: 8.1.1, 8.1.2, 8.1.3, 8.2, 8.2.1)

9 Hrs

Unit III

Bipolar Junction Transistor: Fundamentals of BJT operation, Amplification with BJTS, BJT Fabrication, The coupled Diode model, Switching operation of a transistor, Cutoff, saturation, switching cycle, specifications, Drift in the base region, Base narrowing, Avalanche breakdown, Base Resistance and Emitter crowding. (Text 1: 7.1, 7.2, 7.3, 7.5.1, 7.6, 7.7.1, 7.7.2, 7.7.3, 7.7.5).

9 Hrs

Unit IV

Field Effect Transistors: Basic P-N JFET Operation, Equivalent Circuit and Frequency Limitations, MOSFET- Two terminal MOS structure- Energy band diagram, Ideal Capacitance – Voltage Characteristics and Frequency Effects, Basic MOSFET Operation- MOSFET structure, Current Voltage Characteristics. (Text 2: 9.1.1, 9.4, 9.6.1, 9.6.2, 9.7.1, 9.7.2, 9.8.1, 9.8.2).

8 Hrs

Unit V

Fabrication of p-n junctions: Thermal Oxidation, Diffusion, Rapid Thermal Processing, Ion implantation, chemical vapour deposition, photolithography, Etching, metallization. (Text 1: 5.1) **Integrated Circuits:** Background, Evolution of ICs, CMOS Process Integration, Integration of Other Circuit Elements. (Text 1: 9.1, 9.2, 9.3.1, 9.3.2).

8 Hrs

TEXT BOOKS:

1	Ben. G. Streetman, Sanjay	"Solid State Electronic Devices", 7th Edition, Pearson Education,

	Kumar Banergee	2016, ISBN 978-93-325-5508-2
2	Donald A Neamen, Dhrubes Biswas	"Semiconductor Physics and Devices", 4th Edition, Mc. Graw Hill Education, 2012, ISBN 978-0-07-107010-2.

REFERENCE BOOKS:

1	S. M. Sze, Kwok K. Ng	"Physics of Semiconductor Devices", 3rd Edition, Wiley, 2018.
2	A. Bar-Lev	"Semiconductor and Electronic Devices", 3rd Edition, PHI, 1993

Course Outcomes: After the completion of this course, students will be able to:

CO1	**Interpret** the principles of semiconductor Physics.
CO2	**Analyse** the characteristics of different types of semiconductor devices.
CO3	**Explain** the fabrication process of semiconductor devices
CO4	**Utilize** the mathematical models of semiconductor junctions for circuits and systems.
CO5	**Analyse** mathematical models of MOS transistors for circuits and systems.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

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

Social Connect and Responsibilities

Contact Hours/Week	: 0:0:2 (L+T+P)	Credits:	1.0
Total Lecture Hours	: 26	CIE Marks:	50
Total Tutorial Hours	: 00	SEE Marks:	50
Course Code	: SHSXX		

Objectives: The Course will

1. Enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & The government and build solutions to alleviate these complex social problems through immersion, design & technology.
2. Provide a formal platform for students to communicate and connect with their surroundings.
3. Enable to create of a responsible connection with society.

Learning Outcomes: The students are expected to have the ability to:

1. Understand social responsibility
2. Practice sustainability and creativity
3. Showcase planning and organizational skills

Contents: The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large. The course will engage students in interactive sessions, reading groups and semester-long activities

conducted by faculty mentors. In the following a set of activities planned for the course have been listed:

Unit I

Plantation and adoption of a tree: Plantation of a tree by Miyawaki Method that will be adopted by entire semester by a group of students. They will also make an excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.

6Hrs

Unit II

Heritage walks 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, photoblog and documentary on evolution and practice of various craft forms.

6 Hrs

Unit III

Organic farming: Definition of organic farming, Organically grown crops in India, Differentiate between conventional farming and organic farming, Necessity of organic farming, Key characteristics of organic farming, Four principles of organic farming(principle of Health, principle of ecology, principle of fairness and principle of care),Types of organic farming: 1) Pure organic farming, 2) Integrated farming (Integrated nutrient management and Integrated pest management), objectives of organic farming, benefits of organic farming, Basic steps in organic farming and limitations of organic farming.

4 Hrs

Unit IV

Water Conservation: Global Water Scarcity - Global water crisis and its implications; Rainwater Harvesting - Concept and benefits of rainwater harvesting; Water Audit – An approach to water conservation; Efficient Water Use - Optimizing water consumption in daily life.

6 Hrs

Unit V

Food Walk City's culinary practices, food lore, and indigenous materials of the region used in cooking.

4 Hrs

Activities:

1. **Plantation and adoption of a tree:** Select suitable species in consultation with horticulture, forest or agriculture department. Interact with NGO/Industry and community to plant Tag the plant for continuous monitoring
2. **Heritage walk and crafts corner:** Survey in the form of questioner by connecting to the people and asking. Questions during survey can be asked in local language but report language is English.
3. **Organic farming:** Collect data on organic farming in the vicinity. Like types of crop, methodology etc.,
4. **Water Conservation:** Report on traditional water conservation practices (to minimize wastage)

5. **Food Walk**: Survey local food centres and identify its specialty, Identify and study the food ingredients, Report on the regional foods, Report on Medicinals values of the local food grains, and plants.

Pedagogy

The pedagogy will include interactive lectures, inspiring talks by various departments, field visits, social immersion. Applying and synthesizing information from these sources to define the social problem with your group. Social immersion with NGOs/social sections will be a key part of the course.

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.

A total of 26 hrs engagement per semester for this course in 3rd semester of the B.E. program. The students will be divided into 1 group of 60 each. Each group will be handled by one faculty mentor.

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE)

- Student shall keep a separate dairy and prepare report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period.
- Report shall be handwritten or blog with paintings, sketches, poster, video and/or photograph with Geo tag.
- The report should be signed by the mentor.
- The report shall be evaluated on the basis of the following criteria (see Table below) and/or other relevant criteria pertaining to the activity completed.
- Each module is evaluated for 35 Marks and final presentation will be for 15 marks.

Sl. No.	Particulars (for each module)	Maximum Marks
1	Planning and scheduling the social connect	10
2	Information/Data collected during the social connect	10
3	Report writing	15
4	Final Presentation from the group	15
	Total	**50**

ABILITY ENHANCEMENT COURSES

Introduction of Solar Photovoltaic and Wind Energy System

Lab Hours/ Week	: 0:0:2(L+T+P)	Credits:	1.0
Total Practical hours	: 26	CIE Marks:	50
Total Theory hours	: 0		
Sub. Code	: **S3EEA01**	SEE Marks:	50

Course Objectives: Operating principle, Photovoltaic cell concepts, Types of solar cells, fabrication of SPV cells, Cell, module, array (Series & parallel connections), Concept of bypass diodes, SPV system components and their characteristics, Variation of I-V&P-V characteristics of a solar cell with Insolation and Temperature, Impact of shading condition on solar cell, Applications, Present Status of Solar Power in India.

LIST OF EXPERIMENTS

1. Demonstration of I-V and P-V Characteristics of PV Module with Varying radiation and Temperature.
2. Demonstration of I-V and P-V Characteristics of Series and Parallel Combination of PV Modules.
3. Experiment on the effect of variation of tilt angle on PV module Power.
4. Demonstration of the effect of shading on module Output Power.
5. Evaluation of turbine power of wind turbine versus wind speed curve.
6. Demonstration of characteristics of wind speed v/s turbine RPM.
7. Evaluation of Torque produced by wind turbine v/s wind speed.
8. Calculation of Efficiency of wind turbine v/s Wind Speed
9. Calculation of efficiency of charge controller.

Course outcomes: After studying this course, students will be able to:

1. **Analyse** the IV and PV characteristics of the solar Module.
2. **Analyse** the performance of solar module under different load conditions.
3. **Analyse** the performance characteristics of Wind Energy Conversion Systems

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

		POs											PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
COs	CO1	3	2												2
	CO2	3	2												2
	CO3	3	2											2	2

Electrical Hardware Laboratory

Lab Hours/ Week	: 0:0:2(L+T+P)	Credits:	1.0
Total Practical hours	: 26	CIE Marks:	50
Total Theory hours	: 0		
Sub. Code	: **S3EEA02**	SEE Marks:	50

Course Objectives:

1. To familiarize students with different electric wiring systems
2. Expose students Earthing practices and motor circuits

LIST OF EXPERIMENTS

1. Fluorescent lamp wiring
2. Stair case wiring
3. Residential house wiring using fuse, switch, MCB, indicator, lamp and energy meter
4. Measurement of energy using single phase energy meter
5. Measurement of resistance to earth of electrical equipment
6. Study of Earthing.
7. DOL starter
8. Star-Delta starter.
9. Winding of stator of AC motor.
10. Winding of rotor of AC motor.

Course Outcomes:

After the completion of this course, the students will be able to:

CO1: **Implement** domestic electric wiring systems.

CO2: **Implement** power and control circuits for Motor applications.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

		POs											PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
COs	CO1	3	2											2	
	CO2	3	2											3	

Python Programming Laboratory

Lab Hours/ Week	: 0:0:2(L+T+P)	Credits:	1.0
Total Practical hours	: 26	CIE Marks:	50
Total Theory hours	: 0		
Sub. Code	: **S3EEA03**	SEE Marks:	50

Course Objectives: This course will enable students to:

1	Develop Python programs with conditionals and loops.
2	Define Python functions and call them. use Python data structures — lists, tuples, dictionaries.
3	Understand Input/output operations with files in Python.

Sl. No.	Experiments
1	Introduction data, expressions, statements
2	Control flow, loops
3	Functions, arrays
4	Lists, tuples, dictionaries
5	Files, exceptions, modules, packages

Course Outcomes: After the completion of this course, students will be able to:

CO1	**Develop** and execute Python programs.

CO2	**Develop** programs on Structure for solving problems.
CO3	**Develop** Python program using function concepts.
CO4	**Implement** compound data using Python lists, tuples, dictionaries.
CO5	**Develop** a program for file handling.

Text books:

1. Allen B. Downey, Python: How to Think Like a Computer 2nd edition, Updated for Python 3, Shroff/O 'Reilly Publishers, 2016.
2. R. Nageswara Rao, "Core Python Programming", dreamtech
3. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

Reference books:

1. Core Python Programming, W. Chun, Pearson.
2. Introduction to Python, Kenneth A. Lambert, Cengage
3. Learning Python, Mark Lutz, Orielly

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

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

Fuzzy logic control laboratory

Lab Hours/ Week	: 0+0+2(L+T+P)	Credits:	1.0
Total Practical hours	: 26	CIE Marks:	50
Total Theory hours	: 0		
Sub. Code	: **S3EEA04**	SEE Marks:	50

Course Objectives: This course will enable students to:

1. Understand the Fuzzy Logic, Classical Sets and Fuzzy Sets, Classical Set, Operations on Classical , Properties of Classical ,Mapping of Classical Sets to a Function, Fuzzy Sets , Fuzzy Set Operations ,Properties of Fuzzy Sets.
2. Design Fuzzy Rule-Based System, Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules, Properties of Set of Rules, Fuzzy Inference System, Construction and Working of Inference System, Mamdani's Fuzzy Inference Method.

Sl. No.	**Experiments**
1	Calculate, A ∪ B, A ∩ B, $\bar{}$ A, $\bar{}$B by a Matlab program.
2	Calculate A ∩ $\bar{}$B (difference), B ∩ A$\bar{}$ by writing an M-file
3	Calculate the Demorgan's law A ∪ B = $\bar{}$ A ∩ $\bar{}$B, and A ∩ B = $\bar{}$ A ∪ $\bar{}$B using a matlab program.
4	Illustrate different types of generalized bell membership functions using Matlab program

5	Temperature control of the reactor where the error and change in error is given to the controller. Here the temperature of the reactor is controlled by the temperature bath around the reactor thus the temperature is controlled by controlling the flow of the coolant into the reactor. Form the membership function and the rule base using FIS editor.
6	Consider the water tank with following rules 1. IF (level is okay) THEN (valve is no change) (1) 2. IF (level is low) THEN (valve is open fast) (1) 3. IF (level is high) THEN (valve is close fast) (1) Using Mamdani method and max–min method for fuzzification and method of centroid for defuzzification method construct a FIS.
7	Fuzzy Logic control-based speed control of DC motor
8	Fuzzy Logic MPPT for Solar PV
9	Fuzzy Logic Controller for DC DC converter
10	Fuzzy Logic Controller for Washing Machine

Course Outcomes: After the completion of this course, students will be able to:

CO1	**Acquire** a basic knowledge about Fuzzy logic using MATLAB
CO2	**Analyze** different functions Fuzzy logic in MATLAB
CO3	**Develop** fuzzy logic controller Using MATLAB.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

		POs												PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
COs	CO1	2	2			2								2	2
	CO2	3	3		2	2								2	3
	CO3	2	2		2	2								2	2

Electrical Machines-I

Contact Hours/ Week	: 3+0 (L+T)	Credits:	3.0
Total Lecture Hours	: 42	CIE Marks:	50
Sub. Code	: S4EE03	SEE Marks:	50

Course Objectives: This course will enable students to

1. Understand the operation and performance of DC machine.
2. Interpret the differences in operation of different dc machine configurations and testing of dc machines
3. Analyse the operation and performance of synchronous machines.

Unit-I

D.C. Generators: Principle of operation, basic construction of a DC machine, lap and wave windings, Equation for induced EMF, types of D C generators, relation between induced EMF and terminal voltage, Armature reaction Effect, linear commutation, Methods of improving Commutation, Numerical examples. Open circuit characteristics of separately excited DC generator, voltage build-up in a self-excited generator, critical field resistance and critical speed.

8 Hrs

Unit-II

D.C. Motors: Principle of DC Motor, Back EMF, derivation of torque equation, Types of DC motors, Characteristics of separately excited, shunt and series motors, Speed control of DC shunt and series motors.

8 Hrs

Unit-III

Losses and efficiency, Testing of DC machines – Swinburne's test, Hopkinson's test, merits and demerits of tests, numerical examples.

Synchronous machines: Constructional features, types, Excitation systems, EMF equation, Types of Armature windings, Terms used in armature windings, Coil-span factor and distribution factors.

8 Hrs

Unit-IV

Synchronous machines (Continued): - Armature reaction and its effects, synchronous reactance and impedance. Equivalent circuit and phasor diagram. Voltage regulation. Determination of voltage regulation by EMF, MMF & ZPF-methods, numerical examples.

9 Hrs

Unit-V

Parallel operation of alternators – Necessary of parallel operation, synchronization, Dark lamp method, synchronizing current and power, Parallel operation of two alternators, numerical examples. Effect of change in excitation, Hunting and damper windings. **Synchronous Motors:** Principle of operation**,** Methods of starting, Effect of load on synchronous motor, Effect of change in excitation, V and inverted V Curves. Synchronous condenser, Applications.

9 Hrs

Text books:

1	A. E. Fitzgerald and C. Kingsley	"Electric Machinery", New York, McGraw Hill Education, 2013.

2	Langsdorf A.	Theory of alternating current Machine. TMH., 2001
3	M.G.Say	Performance & Design of AC Machines. CBS Publishers., 2005
4	Nagrath and Kothari.	Electrical Machines. TMH., 2010

Reference books:

1	Kosow.	Electrical Machines and Transformers. Ed 2. PHI., 2007
2	Ashfaq husain	Electrical Machines. Dhanapatharai & Co., 2002

Course Outcomes: After the completion of this course, students will be able to:

Sl. No.	COs
1	Describe the operation and analysis of the performance of DC Generator
2	Describe the operation and analyze the performance of DC motor
3	Analyze the different methods of speed control of DC motor and testing of DC machines
4	Analyze the performance of synchronous machine and determine voltage regulation
5	Analyze parallel operation of synchronous generators and the performance of synchronous motor

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

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

Control system

Contact Hours/ Week	: 3:0:2 (L+T+P)	Credits: 4.0
Total Lecture Hours	: 42	CIE Marks:50
Total Practical Hours	: 26	SEE Marks:50
Sub. Code	: S4CESI01	

Course Objectives: This course will enable students to:

1	Develop mathematical modeling of control systems, and determine its transfer function. Reduce the given electrical system using signal flow graphs technique and obtain the transfer function.
2	Study the transient and steady state response of the system with different input signals. Concept and applications of different types of feedback controllers to control system.
3	Stability analysis of a given system using Routh-Hurwitz criterion and Root locus techniques.
4	Stability analysis of a given system in frequency domain using Bode plots and obtain Gain

	margin & phase margins.
5	Stability analysis using Nyquist Stability criterion, obtain -Gain and phase margin. Design and analyze the Lead, Lag and lag-lead compensators.

Unit I

Modeling of linear-time-invariant Systems: Introduction to control system, Open loop and Closed loop systems. Mathematical models of physical systems–mechanical systems, Electrical systems.

- Translational and rotational systems
- Transfer function of Electrical networks, Relevant examples

Signal flow graphs: signal Flow graph, Mason's gain formula applicable to Electrical and Electronics systems.

8 Hrs

Unit II

Time Response Analysis: Unit step response of first and second order linear-time-invariant systems, time domain specifications, transient response of second order linear-time-invariant systems, steady state error analysis.

Feedback Controllers: Design of feedback controllers based on time response applicable to Electrical & Electronics systems. Relevant examples.

8 Hrs

Unit III

Concept of Stability: Frequency Response Analysis: Routh-Hurwitz Criteria, Relative Stability analysis**. Root-Locus Techniques:** The root locus concepts, Construction of Root-loci, effect of addition of poles and zeros to the linear time invariant systems and its applications to Electrical & Electronics systems.

8 Hrs

Unit IV

Frequency-response analysis: Frequency domain specifications, Correlation between time and frequency response, Polar plots, Bode plots, Closed-loop frequency response from Bode Plot, Stability analysis in Electrical & Electronics systems.

9 Hrs

Unit V

Frequency-response analysis: Nyquist stability, Relative stability using Nyquist Stability Criterion-Gain and phase margin.

System Compensation: Design of Lead compensator, Lag compensator, Lag-Lead compensators as applicable to Electrical & Electronics systems.

9 Hrs

Text books:

1	Richard C. Dorf and Robert H. Bishop	Modern Control Systems, Ed 13, PearsonEducation, 2013, ISBN-10: 0134407628 ISBN-13: 978-0134407623
2	Nagrath and Gopal M.	Control Systems Engineering. Ed 4, New AgeInternational (P) Limited.2005. ISBN 10: 8122422845ISBN 13: 9788122422849.
3	Adel S. Sedra, Kenneth C. Smith	Microelectronic Circuits: Ed 5, New York OXFORD UNIVERSITY PRESS 2004. ISBN 0-19-514252-7.

Reference books:

1	Ogata K.	Modern Control Engineering. Ed 4. Pearson Education Asia/PHI. 2002.
2	Kuo C. Benjamin	Automatic Control Systems, Wiley; 9th Edition, 2014 Language: English, ISBN 10: 9788126552337 ISBN-13: 978-8126552337

Course Outcomes: After the completion of this course, students will be able to:

CO1	Formulate the mathematical model for linear-time-invariant systems and obtain the transfer functions using signal flow graphs.
CO2	Analyze transient and steady state responses for first order and second order linear-time-invariant systems with standard signals. Design and analyze the performance of feedback controllers to improve the stability of linear-time-invariant systems.
CO3	Analyze and interpret the stability of linear-time invariant systems by applying RH criteria and root locus techniques.
CO4	Analyze and interpret the stability of linear-time-invariant systems in frequency domain by polar plot and Bode plot techniques.
CO5	Analyze and interpret the stability using Nyquist stability criterion. Design and analyse the lead, lag and lead-lag compensators for improving the stability and performance of linear-time-invariant systems.

Integrated Lab

Sl. No.	Experiments
1	Using MATLAB/ SCILAB/Any tool: a) Simulation of a second order system and determination of step response and evaluation of time domain specifications for any given electrical system. b) Evaluation of the effect of additional poles and zeroes on time response of a given second order system. c) Evaluation of effect of pole location on stability. d) Effect of loop gain of a negative feedback system on stability of a given electrical system.
2	To study step response transient and steady state response of a second order system series RLC electrical circuit for
3	To study the effect of P, PI, PD and PID controller on step response of a feedback control system using hardware setup.
4	To design a phase lead compensating network for the given specifications, and determine maximum phase lead and the frequency obtain its frequency response. a) Experiment to draw the frequency response characteristic of a given lead compensating network. b) To determine the transfer function from obtained frequency response characteristics.
5	To design phase lag compensating network for the given specifications and determine the maximum phase lag and the frequency and obtain its frequency response. a) Experiment to draw the frequency response characteristic of a given lead compensating network.

	b) To determine the transfer function from obtained frequency response characteristics.
6	Experiment to draw the frequency response characteristic of a given lag- lead compensating network.
7	Using MATLAB/SCILAB: a) To examine the relationships between open-loop frequency response and stability, open loop frequency and closed loop transient response. b) To study the effect of addition closed loop poles and zeroes on closed loop transient response.
8	Using MATLAB/SCILAB a) Effect of open loop and zeroes on root locus contour. b) To estimate effect of open loop, gain on the transient response of closed loop system by using Root locus. c) Comparative study of Bode, Nyquist and Root locus with respect to Stability of a system.
9	a) Design a P, PI, PID controller to study its transient and steady state behavior for different types of input. b) Design a P, PI, PID controller to control the speed of a DC motor

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

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

ARM Microcontroller

Contact Hours/ Week	: 3:0:2 (L+T+P)	Credits:	4.0
Total Lecture Hours	: 40	CIE Marks:	50
Total Practical Hours	: 26	SEE Marks:	50
Sub. Code	: S4CESI01		

Course objectives: This course will enable students to

1. Describe basic understanding of ARM processor and peripherals.
2. Provide efficient solutions to real life problems using ARM Architecture and cache, MMUs**.**

Unit I

ARM Embedded Systems: Harvard and Von-Neumann Architecture, CISC vs RISC[Ref:1], RISC design philosophy, ARM design philosophy, embedded system hardware, embedded system

software. [Text:1], ARM7TDMI processor core diagram, [Ref:2]

8 Hrs

Unit II

ARM Processor Fundamentals: ARM Data flow Model [Text1], Processor Operating States, Memory formats: Big endian and Little-endian formats, Data types, Operating Modes, Registers – ARM state register set and Thumb state register set, the relationship between ARM state and Thumb state registers, Program Status Registers, Exceptions, Interrupt latencies, Reset, [Text:1 and Ref:1] Pipeline [Text1- Section 2.3].

8 Hrs

Unit III

LPC214X ARM-based microcontroller: Features of LPC214x Microcontroller, LPC 214x block diagram [Ref:3], Memory Maps [Ref:3 Section 2.1]. Register description [Ref:3] and C-programming of GPIO; ADC. Interfacing LED, Switch, Push button keys to LPC214x microcontroller.

8 Hrs

Unit IV

Caches: The Memory Hierarchy and Cache Memory, Cache Architecture Cache Policy, concepts of Flushing and Cleaning Cache Memory, concepts of Cache Lockdown. [Text:1], **Memory Protection Units**: Protected Regions, concept of access permission. [Text:1].

8 Hrs

Unit V

Memory Management Units: How Virtual Memory Works, Details of the ARM MMU, Page Tables, The Translation Lookaside Buffer, Domains and Memory Access Permission, The Caches and Write Buffer. [Text:1].

Text book:

1.	Andrew N. Sloss, Dominic Symes and Chris Wright	ARM System Developer's Guide – Designing and Optimizing System Software, Elsevier 2004.

Reference:

1	Shibhu K.V	Introduction to Embedded Systems, 2nd Edition TMH 2017.
2	ARM7TDMI	Datasheet
3	UM10139 LPC214x User manual	

INTEGRATED LAB (For CIE only)

Using Embedded C and/ or LPC 2148

1. Programs for addition/ subtraction/ multiplication of numbers
2. Programs for sorting of numbers.
3. Develop a program for Flashing LED
4. Develop a program to generate square wave / sine wave/ triangular wave using GPIO
5. Develop a program to turn on LED whenever a push button is pressed and sound the alarm
6. Develop a program to convert given analog voltage to digital value

7. Develop a program to generate a square wave on a GPIO pin when a key is pressed and stop whenever key is released
8. Develop a program to interface a DC motor and rotate it in clockwise and anticlockwise direction.
9. Develop a program to interface LCD unit and display a message.
10. Develop a program to generate square wave / sine wave/ triangular/Staircase wave using DAC of LPC2148
11. Develop a program to display the key pressed from keypad over a 16X2 LCD using LPC2148

Course Outcomes: After the completion of this course, students will be able to:

CO1	Identify and analyze typical hardware and software technologies that surround an ARM controller.
CO2	Analyse the programmer's model of the ARM controller.
CO3	Analyse the functionalities and Design software solutions using ADC, GPIO for ARM based Microcontroller-**LPC 214x**
CO4	Illustrate things a cache memory can do to make programs on ARM controller run faster.
CO5	Analyze functionality of ARM memory management units and Memory Protection Units
CO6	Demonstrate the ability to provide efficient solutions for complex engineering problems using Embedded C in the area of ARM controllers individually and working in a team (CO for laboratory)

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

		POs												PSOs	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
COs	**CO1**	**1**	**3**												**2**
	CO2	2	2												**2**
	CO3	2	2			**1**					**1**			**1**	**1**
	CO4	2	3												**3**
	CO5	2	3												**3**
	CO6	3	3	**1**		**2**					**1**		**1**	**1**	**2**

Electrical Machines-I Laboratory

Lab Hours/ Week	: 0:0:2(L+T+P)	Credits:	1.0
Total Practical hours/week	: 02	CIE Marks:	50
Sub. Code	: S4EEL01	SEE Marks:	50

Course objectives:

1. Analyse the performance indices of DC and AC machines
2. Performance analysis of speed control techniques for DC machines.

LIST OF EXPERIMENTS:

1. Open Circuit Characteristics (OCC) of a DC shunt generator
2. Load Characteristics of a DC shunt generator
3. Load Characteristics of a DC shunt motor
4. Speed control of D. C. shunt motor
5. Efficiency of two identical DC machines by Hopkinson's Test
6. Synchronization of alternator
7. Voltage Regulation of Alternator by EMF method
8. Voltage Regulation of Alternator by MMF method
9. Voltage Regulation of Alternator by ZPF method
10. V and inverted V- Curves of Synchronous Motor

Course outcomes: After the completion of this course, students will be able to:

1. Analyse the load characteristics of DC machines
2. Analyse the speed control of DC motor
3. Test a given DC machine.
4. Determine voltage regulation of alternators
5. Analyse the performance of synchronous motor.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

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

Biology for engineers

Contact Hours/Week	: 3+0+0 (L+T+P)	Credits	: 3
Total Lecture Hours	: 40	CIE Marks	: 50
Course Code	: N4CCA01	SEE Marks	: 50

Course objectives:

1. To familiarize the students with the basic biological concepts and their engineering applications.
2. To enable the students with an understanding of biodesign principles to create novel devices and structures.
3. To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
4. To motivate the students to develop interdisciplinary vision of biological engineering.

Teaching-Learning Process (General Instructions)

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

- Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning /inquiry-based teaching.
- Instructions with interactions in classroom lectures (physical/hybrid).
- Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
- Flipped classroom sessions (~10% of the classes).
- Industrial visits, Guests talks and competitions for learning beyond the syllabus.
- Students' participation through audio-video based content creation for the syllabus (as assignments).
- Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes.
- Students' seminars (in solo or group) /oral presentations.

Unit I

Introduction to biology: The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each), Properties and functions), vitamins and hormones.

8 Hrs

Unit II

Biomolecules and their applications (qualitative): Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/ detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching)

8 Hrs

Unit III

Human organ systems and bio designs (qualitative): Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease). Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung

machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).

8 Hrs

Unit IV

Nature-bioinspired materials and mechanisms (qualitative): Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes-hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).

8 Hrs

Unit V

Trends in bioengineering (qualitative): Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self- healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

8 Hrs

Course outcome

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

1. Elucidate the basic biological concepts via relevant industrial applications and case studies.
2. Evaluate the principles of design and development, for exploring novel bioengineering projects.
3. Corroborate the concepts of biomimetics for specific requirements.
4. Think critically towards exploring innovative biobased solutions for socially relevant problems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.
- Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

- Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/121106008
- https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
- https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https://www.coursera.org/courses?query=biology
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- https://www.classcentral.com/subject/biology
- https://www.futurelearn.com/courses/biology-basic-concepts

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

- Group Discussion of Case studies.
- Model Making and seminar/poster presentations.
- Design of novel device/equipment like Cellulose-based water filters, Filtration system.

Engineering Science Course

Engineering materials

Contact Hours/Week	:	3 (L)	Credits	:	3.0
Total Lecture Hours	:	42	CIE Marks	:	50
Total Tutorial Hours	:	--	SEE Marks	:	50
Course Code	:	S4EESC01			

Course Objectives: This course will enable students to:

1	Understand conducting, dielectric, insulating and magnetic materials and their applications.
2	Describe superconducting materials and their applications

Unit I

Introduction to Electrical and Electronic Materials: Importance of materials, Classification of electrical and electronic materials, Scope of electrical and electronic materials, Requirement of Engineering materials, Operational requirements of electrical and electronic materials, Classification of solids on the basis of energy gap, Products – working principle and materials, Types of engineering materials, Levels of material structure. Spintronics and Spintronic materials, Ferromagnetic semiconductors, Left-handed materials.

8 Hrs

Unit II

Conductors: Conductor materials, Energy Band Theory, Factors affecting conductivity, Thermal conductivity, Heating effect of current, Thermoelectric effect, Seebeck effect, Thomson effect, Wiedemann – Franz law and Lorentz relation, Problems. **Conductive Materials and Applications:** Mechanically processed forms of electrical materials, Types of conducting materials, Low resistivity materials, High resistivity materials, contact materials, Fusible materials, Filament materials, Carbon as filamentary and brush material, Material for conductors, cables, wires, solder, sheathing and sealing.

8 Hrs

Unit III

Dielectrics: Introduction to dielectric materials, classification of dielectric materials, Dielectric constant, Dielectric strength and Dielectric loss. Polarization, Mechanisms of polarization, Comparison of different polarization process, Factors affecting polarization, Spontaneous polarization, Behavior of polarization under impulse and frequency switching, Decay and build-up of polarization under ac field, Complex dielectric constant.

Insulating Materials: Insulating materials and applications – Ceramic, Mica, Porcelain, Glass, Micanite and Glass bonded mica. Polymeric materials – Bakelite, Polyethylene. Natural and synthetic rubber. Paper. Choice of solid insulating material for different applications, Liquid insulating materials – Requirements, Transformer oil, Bubble theory, Aging of mineral insulating oils. Gaseous insulating Materials – Air, Nitrogen, Vacuum.

9 Hrs

Unit IV

Magnetic Materials: Origin of permanent magnetic dipole, Magnetic terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetism, Ferromagnetism, Antiferromagnetic and the corresponding materials. Ferrimagnetism and ferrites – properties and applications, Soft and hard ferrites. Curie temperature,

Laws of magnetic materials. Magnetization curve, Initial, and maximum permeability. Hysteresis loop and loss, Eddy current loss. Types of magnetic materials, Soft and hard magnetic materials, High energy magnetic materials, Commercial grade soft and hard magnetic materials.

9 Hrs

Unit V

Superconductive Materials: Concept of superconductors, Meaning of phenomenon of superconductivity, Properties of superconductors, Types of superconductors, Critical magnetic field and critical temperature, Effects of Isotopic mass on critical temperature, Silsbee rule, Depth of penetration and coherence length. Ideal and Hard superconductors, Mechanism of super conduction, London's theory for Type I superconductors, Applications and limitations. Applications of high temperature superconductors, Superconducting solenoids and magnets. **Polymers:** Introduction, Thermoplastics, Rubbers, Thermosets, DC and AC properties, Mechanical properties and processing.

8Hrs

TEXT BOOKS:

1	K.M. Gupta, Nishu Gupta	Advanced Electrical and Electronics Materials; Processes and Applications Wiley 1st Edition, 2015, ISBN-10 1118998359, ISBN-13 978-1118998359

REFERENCE BOOKS:

1	R.K. Shukla, Archana Singh	Electronic Engineering Materials McGraw Hill 2012
2	L Solymar et al	Electrical Properties of Materials Oxford 9th Edition, 2014
3	A.J. Dekker	Electrical Engineering Materials Pearson 2016
4	S.O. Kasap	Principle of Electronic Materials and Devices McGraw Hill 3rd Edition 2010

Course Outcomes: After the completion of this course, students will be able to:

CO1	**Interpret** electrical and electronics materials, their importance, classification and operational requirement.
CO2	**Summarize** conducting materials used in engineering applications, their properties and classification.
CO3	**Illustrate** dielectric, insulating materials used in engineering, their properties and classification.
CO4	**Discuss** magnetic materials used in engineering, their properties and classification.
CO5	**Infer** the superconductivity phenomenon, super conducting materials, polymer and its properties and application in engineering.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

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

Basic VLSI Design

Contact Hours/Week	:	3 (L) +2(P)	Credits	:	3.0
Total Lecture Hours	:	42	CIE Marks	:	50
Total Tutorial Hours	:	--	SEE Marks	:	50
Course Code	:	S4EESC02			

Course Objectives: This course will enable students to:

1	Understand the fundamental aspects of circuits in silicon.
2	Relate VLSI design processes and design rules to industrial applications.

Unit I

Introduction: Moore's law, speed power performance, nMOS fabrication, CMOS fabrication: n-well, well processes, BiCMOS, Comparison of bipolar and CMOS. Basic Electrical Properties of MOS And BiCMOS Circuits: Drain to source current versus voltage characteristics, threshold voltage, transconductance.

8 Hrs

Unit II

nMOS inverter, Determination of pull up to pull down ratio: nMOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, BiCMOS inverters, latch up. **Basic Circuit Concepts:** Sheet resistance, area capacitance calculation, Delay unit, inverter delay, estimation of CMOS inverter delay, super buffers, BiCMOS drivers

8 Hrs

Unit III

MOS and BiCMOS Circuit Design Processes: MOS layers, stick diagrams, nMOS design style, CMOS design style Design rules and layout & Scaling of MOS Circuits: λ - based design rules, scaling factors for device parameters

8 Hrs

Unit IV

Subsystem Design and Layout-1: Switch logic pass transistor, Gate logic inverter, NAND gates, NOR gates, pseudo nMOS, **Dynamic CMOS Examples of structured design:** Parity generator, Bus arbitration, multiplexers, logic function block, code converter.

9 Hrs

Unit V

Subsystem Design and Layout-2: Clocked sequential circuits, dynamic shift registers, bus lines, General considerations, 4-bit arithmetic processes, 4-bit shifter, Regularity- Definition & Computation, Practical aspects and testability: performance, optimization and CAD tools for design and simulation.

9 Hrs

Text books:

1	Douglas A Pucknell, Kamran Eshraghian	"Basic VLSI Design", 3rd Edition, Prentice Hall of India publication, 2005. ISBN-10 8120309863 ISBN-13 978-8120309869

Reference books:

1	Sung – Mo (Steve) Kang, Yusuf Leblebici	"CMOS Digital Integrated Circuits, Analysis And Design", , Tata McGraw Hill, 3rd Edition, 2003.
2	S.M. Sze	"VLSI Technology", 2nd edition, Tata McGraw Hill, 2003.

Course Outcomes: After the completion of this course, students will be able to:

CO1	**Identify** the CMOS layout levels, and the design layers used in the process sequence.
CO2	**Describe** the general steps required for processing of CMOS integrated circuits.
CO3	**Design** static CMOS combinational and sequential logic at the transistor level.
CO4	**Demonstrate** different logic styles such as complementary CMOS logic, pass-transistor Logic, dynamic logic, etc.
CO5	**Interpret** the need for testability and testing methods in VLSI.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

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

Digital Signal Processing

Contact Hours/Week	:	3 (L)	Credits	:	3.0
Total Lecture Hours	:	42	CIE Marks	:	50
Total Tutorial Hours	:	--	SEE Marks	:	50
Course Code	:	S4EESC03			

Course Objectives: This course will enable students to:

1	Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling
2	Analyse different techniques of digital signal processing that are fundamental to various industrial applications.

Unit I

Discrete Fourier transform: Introduction, Fourier representations of finite-duration sequences, properties of DFT, Linear convolution using DFT, computation of Circular convolution and correlation.

9 Hrs

Unit II

Computation of DFT: Fourier representations of finite-duration sequences, properties of DFT(Qualitative), Decimation-in-time and decimation-in-frequency radix-2 FFT and IFFT algorithms, FFT of a composite number, Applications of FFT algorithms, Linear filtering approach

to computation of the DFT - Goertzel and Chirp transform algorithms.

8 Hrs

Unit III

Filter design Techniques: Ideal filter characteristics, low-pass, high-pass and band-pass filters; digital resonators, notch filters, comb filters, all-pass filters, Minimum phase systems. **Design of FIR filters**: Issues in filter design, importance of linear phase, frequency response of linear phase FIR filters, locations of zeros of FIR filters, Design techniques of FIR filters, windowing, frequency sampling method, design of Hilbert transformer, differentiators, comparison of FIR and IIR filters.

9 Hrs

Unit IV

Design of IIR filters: Elementary properties of IIR filters, Techniques for determining IIR filter coefficients, frequency transformations in analog domain. Introduction to analog filters, Digital filter design from continuous-time filters, impulse invariant transformation and bilinear transformation methods.

8 Hrs

Unit V

Basic structures for FIR systems: Direct, Cascade, Linear Phase, frequency sampling and Lattice structures. Structures for IIR systems: Direct, Cascade, Parallel, and Lattice structures.

8 Hrs

Text books:

1	J. G. Proakis and D. G. Manolakis	Digital Signal Processing: Principles, Algorithms and Applications, Pearson Education India (1 January 2007) **ISBN**-10: 9788131710005
2	Li Tan, Jean Jiang	"Digital Signal processing- Fundamentals and Applications", Academic Press, 2013, ISBN: 978-0-12-415893. 97

Reference books:

1	S. K. Mitra	Digital Signal Processing: A Computer-Based Approach. TMH. 2/E, 2013. ISBN-10: 1259098583
2	Lonnie C. Ludeman	Fundamentals of Digital Signal Processing, John Wiley & sons. ISBN-10: 0471613061

Course Outcomes: After the completion of this course, students will be able to:

CO1	**Apply** the knowledge of DFT to analyze the properties of signal processing.
CO2	**Apply** different FFT computation methods to find DFT of the signals.
CO3	**Analyze** and **design** FIR filters by selecting appropriate windows for the required specifications.
CO4	**Analyze** and **design** IIR filters using bilinear and impulse invariant techniques for develop mathematical model
CO5	**Formulate** the structures for FIR and IIR systems to analyze filters.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

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

Linear integrated circuits and applications

Contact Hours/ Week	: 3 (L)	Credits:	3
Total Lecture Hours	: 42	CIE Marks:	50
Sub. Code	: S4EESC04	SEE Marks:	50

Course Objectives:

1. Analyze the stability of the op-amp circuits, response of circuits in terms of frequency design the circuits to process the signals.
2. Design non-linear circuits of op-amp such as crossing detectors, Schmitt trigger and multivibrator, triangular and square wave generator.
3. Analyze the 1st, 2nd order low and high pass filters.

Unit I

Fundamentals of Op-amps: Review of amplifier and differential amplifier fundamentals. Operational-amplifiers: Block diagram, Ideal and Practical Op-Amp characteristics (interpretation of op-amp data sheet), equivalent circuit and voltage transfer curve. Biasing- necessity of constant current bias- with and without diode compensation, using Zener, current mirror.

9 Hrs

Unit II

The practical op-amp: Input Offset Voltage, Input Bias Current, Input Offset Current, Total output Offset Voltage, thermal drift, error voltage, CMRR. **Frequency response:** Frequency response of op-amp- Introduction, compensating networks, high frequency op-amp equivalent circuit, open loop voltage gain as a function of frequency and closed-loop frequency response.

8 Hrs

Unit III

Applications of Operational Amplifier-I: Inverting and Non inverting Amplifiers – practical Gain, input impedance, output impedance, analysis by considering Input Offset Voltage, Input Bias Current and Input Offset Current. DC and AC Amplifier. **Filters:** Classification of filters, first and second order low-pass and high-pass Butterworth filter, Band-pass filters, Band reject filters, All-pass filters.

8 Hrs

Unit IV

Slew rate- causes of slew rate, slew rate equation, effect of slew rate in applications and difference between bandwidth, transient response and slew rate. **Applications of Operational Amplifier-II**:

Voltage to current converter with floating and grounded load, non-inverting integrator, High input impedance circuit, Integrator, Differentiator, comparators, ZCD, Schmitt trigger, peak detector, sample and hold circuit.

9 Hrs

Unit V

Oscillators: Principle of working of oscillators, Classification of oscillators, Phase Shift oscillator, Wein Bridge oscillator, Square and Triangular Wave Generator. Switched capacitor filter – theory of operation, switched capacitor integrator. **Specialized IC applications:** IC565 – Phase Locked Loop applications as Frequency Multiplier. **Voltage regulators:** Simple OP-AMP Voltage regulator, Three terminal Voltage regulators, Fixed and Adjustable Voltage Regulators (78XX, 79XX, LM317).

8 Hrs

Text Books:

1	Ramanath A. Gayakwad	Op-amps and Linear Integrated circuits. PHI. 3rd and 4th edition, ISBN-13 978-9332549913
2	Adel S. Sedra, Kenneth C. Smith	Microelectronic circuits, Oxford University press, 8th edition, OUP USA, 2007, ISBN-13 978-0190853464

Reference Books:

1	Tobey-Graeme-Huelsman	Operational amplifier. McGraw Hill.
2	Clayton G.B.	Operational amplifier. Ed 2. ECBS., 2013
3	Soclof	Applications of analog IC's. PHI., 1985
4	Robert F. Coughlin and Frederick F, Driscoll	Operational Amplifiers and Linear integrated Circuits, PHI., 1998
5	Sergio Franco	Design with op-amps and Analog IC's. Ed 2. McGraw Hill., 2002
6	Roy Choudhury	Operational amplifiers and Linear Integrated circuits , New Age International., 2003

Course Outcomes: After the completion of this course, students will be able to:

CO1	**Analyze** the stability of the op-amp circuits, response of circuits in terms of frequency design the circuits to process the signals.
CO2	**Design** non-linear circuits of op-amp such as crossing detectors, Schmitt trigger and multivibrator, triangular and square wave generator.
CO3	**Analyze** the 1st, 2nd order low and high pass filters.
CO4	**Design** applications of specific op-amp ICs.
CO5	**Design** the op-amp circuit to regulate the DC voltage.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

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

ABILITY ENHANCEMENT COURSE

Simulation Of Electronic Circuits Using Spice

Lab Hours/ Week	: 0:0:2(L+T+P)	Credits:	1.0
Total Practical hours	: 26	CIE Marks:	50
Total Theory hours	: 0		
Sub. Code	: **S4EEA01**	SEE Marks:	50

Course Objectives: This course will enable students to:

1	Simulate different electronic circuits to interpret their working.
2	Design and implement different electronic circuits to verify the output.

Sl. No.	Experiments
1	Verification of Half–Wave and Full-Wave Rectifier
2	Design and verification of clippers, clampers
3	Implementation of Boolean logic functions using basic gates
4	Implementation of Boolean logic functions using universal gates
5	Frequency Response of CE Amplifier
6	Frequency Response of CS Amplifier
7	Verification of Low pass and High pass Filter
8	Design and verification of Wein-Bridge Oscillator
9	Design and verification of RC-Phase Shift Oscillator
10	Design and Verification multiplexers

Course Outcomes: After the completion of this course, students will be able to:

CO1	Design & explain different digital and analog electronic circuits.
CO2	Analyze different digital and analog electronic circuits working.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

		POs												PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
COs	CO1	3	3			2									2
	CO2	3	3			2									2

IC's and PLC Automation Laboratory

Lab Hours/ Week	: 0:0:2(L+T+P)	Credits:	1.0
Total Practical hours	: 26	CIE Marks:	50
Total Theory hours	: 0		
Sub. Code	: **S4EEA02**	SEE Marks:	50

Course Objectives: This course will enable students to:

1	Understand automation technologies and identify advantages, limitations and applications.
2	Develop ability to recognize, articulate and solve industrial problems using automation.

Sl. No.	**Experiments**
1	Design Analog to Digital Converter (Flash type) using op-amp.
2	Design Wein Bridge and RC Phase-Shift Oscillators.
3	Design voltage regulator using IC.
4	Design op-amp applications (ZCD, Schmitt Triger and square wave generator).I
5	Introduction to PLC programming software, ladder logic and PLC programming.
6	Programming and configuration of PLC.
7	Introduction to HMI display and programming the HMI
8	Conveyor Belt Assembly using PLC
9	Introduction to SCADA software to interface with the PLC
10	SCADA software interfacing with the PLC

Course Outcomes: After the completion of this course, students will be able to:

CO1	**Analyze** & explain different functions of PLC.
CO2	**Develop** PLC based SCADA systems for various industrial applications.
CO3	**Implement** HMI, distributed control system and Industry standard 4.0

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

		POs												**PSOs**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
COs	**CO1**	**3**	**3**			**2**									**2**
	CO2	**3**	**3**			**2**									**2**
	CO3	**3**	**3**			**2**									**2**

Web Technology Laboratory

Lab Hours/ Week	: 0:0:2(L+T+P)	Credits:	1.0
Total Practical hours	: 26	CIE Marks:	50
Total Theory hours	: 0		
Sub. Code	: **S4EEA03**	SEE Marks:	50

Course objectives: This course will enable students to:

1. Develop an ability to design and implement static and dynamic website
2. Understand, analyze and create XML documents and XML Schema
3. Understand, analyze and build web applications using PHP and use appropriate client-side or Server-side applications.
4. Handling Cookies and Sessions using PHP, SERVLETS and JSP

Sl. No	List of programs
1	Design the following static web pages required for an online book store web site. HOME PAGE: The static home page must contain three frames. LOGIN PAGE CATOLOGUE PAGE: The catalogue page should contain the details of all the books available in the web site in a table. REGISTRATION PAGE
2	Write JavaScript to validate the following fields of the Registration page. First Name (Name should contains alphabets and the length should not be less than 6 characters). Password (Password should not be less than 6 characters length). E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com) Mobile Number (Phone number should contain 10 digits only). Last Name and Address (should not be Empty).
3	Develop and demonstrate the usage of inline, internal and external style sheet using CSS
4	Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems: Input: Click on Display Date button using onclick() function Output: Display date in the textbox Input: A number n obtained using prompt Output: Factorial of n number using alert Input: A number n obtained using prompt Output: A multiplication table of numbers from 1 to 10 of n using alert Input: A number n obtained using prompt and add another number using confirm Output: Sum of the entire n numbers using alert.
5	Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).

6	Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.
7	Develop and demonstrate PHP Script for the following problems: Write a PHP Script to find out the Sum of the Individual Digits. Write a PHP Script to check whether the given number is Palindrome or not
8	Create an XML document that contains 10 users information. Write a Java Program, which takes User Id as input and returns the user details by taking the user information from XML document using DOM parser or SAX parser.
9	Implement the following web applications using (A) PHP B) Servlets C) JSP A web application that takes a name as input and on submit it shows a hello <name> page where name is taken from the request. It shows the start time at the right top corner of the page and provides a logout button. On clicking this button, it should show a logout page with Thank You <name > message with the duration of usage (hint: Use session to store name and time).
10	Write a PHP Program to display current Date, Time and Day.
11	A web application that takes name and age from an HTML page. If the age is less than 18, it should send a page with “Hello <name>, you are not authorized to visit the site” message, where <name> should be replaced with the entered name. Otherwise, it should send “Welcome <name> to this site” message.
12	A web application that lists all cookies stored in the browser on clicking “List Cookies” button. Add cookies if necessary.

Course outcomes: Upon successful completion of this course, the students will be able to:

1. Design and implement dynamic websites with good aesthetic sense of design.
2. Design web pages using HTML and Cascading Styles sheets.
3. Design dynamic web pages using JavaScript.
4. Build web applications using PHP and create XML documents and XML Schema.
5. Understand, analyze and apply the role of languages like HTML, CSS, XML, JavaScript, PHP, SERVLETS, JSP and protocols in the workings of the web and web applications.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes

		POs												PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
COs	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

Database Management System Laboratory

Lab Hours/ Week	: 0:0:2(L+T+P)	Credits:	1.0
Total Practical hours	: 26	CIE Marks:	50
Total Theory hours	: 0		
Sub. Code	: **S4EEA04**	SEE Marks:	50

Course Objectives: This course will enable students to:

Learn data modelling concepts, design and maintain database using SQL.

List of Experiments

Consider the following Employee database.

- Department (Deptno, Deptname, Location)
- Employee (EmpNo, EmpName, Job, Manager, HireDate, Salary, Commission, Deptno)
- SalaryGrade (Grade, LowSalary, HighSalary)
- Create the above tables by properly specifying the primary keys and the foreign keys
- Enter at least ten tuples for each relation.

Write the queries for the following requirements:

Practicals – 1: (Simple Queries)

1. List the names of analysts and salesmen.
2. List names of employees who are not managers.
3. List the names of employees whose employee numbers are 7369, 7521, 7839, 7934, 7788.
4. List employees not belonging to department 30, 40, or 10.
5. List employee names for those who have joined between 30 June and 31 Dec. ‘81.
6. List the different designations in the company.
7. List the names of employees who are not eligible for commission.
8. List the employees not assigned to any department.
9. List the employees who are eligible for commission.
10. List employees whose names either start or end with “S”.
11. List names of employees whose names have “i” as the second character.
12. List details of employees who have joined before 30 Sep 81.

Practicals – 2: (Based on Order by and Like Operators)

1.List all details from salgrade table.
2.Display different job types without duplicating
3.List employees in department 10 and 30 in alphabetical order of names
4.List clerks in department 20
5.List employees having ‘LL’ or ‘TH’ in their names
6.List employees who do not have manager.
7. List employees hired during any 2 dates (use substitution variable).
8. List all clerks earning less than 1000.
9. List employees having annual remuneration > 30000

Practicals – 3: (Based on Aggregate functions)

1. List the number of employees working with the company.
2. List the number of designations available in the EMP table.
3. List the total salaries paid to the employees.

4. List the maximum, minimum and average salary in the company.
5. List the maximum salary paid to a salesman.
6. List the number of employees and average salary for employees in department 20.
7. List names of employees who are more than 26 years of experience in the company.
8. List the employee details in the ascending order of their basic salary.

Practicals – 4: (Based on Joining tables type)

1. To display ename, job, dname who are working in a SALES department.
2. To display ename, job, dname who are working either in ACCOUNTING or RESEARCH department.
3. To display ename, job, dname, sal who are working in a ACCOUNTING department and drawing salary greater than 1500.
4. To display ename, job, dname who are working in a SALES department as SALESMAN.
5. To display ename, job, dname who are working at a location DALLAS.
6. To display ename, job, dname who are working in a SALES department and drawing salary in the range of 1200 and 1700.
7. To display the dname in which no employee is working.

Practicals – 5: (Based on Group by Clause and Aggregate functions)

1. List the department numbers and number of employees in each department.
2. List the department number and total salary payable in each department.
3. List the jobs and number of employees in each job.
4. List the total salary, maximum and minimum salary and average salary of the employee's job wise.
5. List the total salary, maximum and minimum salary and average salary of the employees, for department 20.

Practicals-6:

Consider the following database of student enrollment in courses and books adopted for each course.

STUDENT (USN, StudentName, Dob, Gender, Class)
COURSE (CourseNo, CourseName, Department)
TEXT (BookId, BookTitle, Publisher, Author)
ENROLL (USN, CourseNo, Semester, Marks)
BOOK_ADOPTION (CourseNo, BookId, Semester)

Create the above tables by properly specifying the primary keys and the foreign keys

Enter at least 10 records to each table.

Execute SQL queries for the following requirements:

1) List the student details and their course details for a particular semester.
2) List the student details under a particular department whose name is ordered in an ascending order.
3) List all the book details under a particular course.
4) List the courses in which number of students enrolled will be more than 2.
5) List the publisher who has published more than 2 books.

Practicals-7:

Consider the following above database:

Execute SQL queries for the following requirements:

1) List the author details who has authored more than 2 books.
2) List the author details who have written book for I semester, computer science course.
3) List only the girls student details whose total number of months starting from their date of birth is more than 200.
4) Update the marks by giving grace marks of 15 % to the boys student who has scored lowest in his class of a particular course.
5) List the course to which maximum number of students have joined

Text Books

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Elmasri and Navathe	Fundamentals of Database Systems, 5th Edition, Addison-Wesley, 2007 (Chapters 1, 2, 3 except 3.8, 5, 6.1 to 6.5, 7.1, 8, 10, 11).
2.	Raghu Ramakrishnan and Johannes Gehrke	Database Management Systems, 3rd Edition, McGraw-Hill, 2003.(Chapters 16, 17.1, 17.2, 18)

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	**Analyse** the Entity Relational model concepts and Design relational algebraic expressions for SQL queries
CO2	:	**Illustrate** the various concepts of SQL and Develop Queries to perform CRUD (Create, Retrieve, Update and Delete) operations on database

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

		POs												PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
COs	CO1	3	2			2									2
	CO2	3	2			2									2