H. K. E. SOCIETY'S
POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, KALABURAGI
B.E in Respective Branch Name Scheme of Teaching and Examination 2022
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2023-24)

III Semester

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Weeks				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self Study	Duration in Hours	SEE Marks	CIE Marks	Total Marks	
					L	T	P	S					
1	PCC	22MA31C	Mathematics	Mathematics	3	0	0	-	03	50	50	100	3
2	IPCC	22EC32	Electronics Circuits	E & CE	3	0	2	-	03	50	50	100	4
3	IPCC	22EC33	Networks and Linear Control Systems	E & CE	3	0	2	-	03	50	50	100	4
4	PCC	22EC34	Digital Electronics	E & CE	3	0	0	-	03	50	50	100	3
5	PCCL	22ECL35	Digital Electronics Lab	E & CE	0	0	2	-	03	50	50	100	1
6	ESC	22EC36A	Signals and Systems	E & CE	3	0	0	-	03	50	50	100	3
7	UHV	22UHV37	Social Connect and Responsibility	E & CE	0	0	2	-	02	50	50	100	1
8	AEC	22ECAE381	Fundamentals of Computer System and Office		If the Course is a Theory				02	50	50	100	1
					0	2	0	-					
					If the course is a Laboratory				03				
					0	0	2	-					
9	NCMC	22NS39	Mandatory Course	NSS Coordinator	0	0	2	-	-	50	-	50	0
		22PE39	Mandatory Course	Physical Education Director									
		22YO39	Mandatory Course	Yoga Teacher									
									Total	**450**	**400**	**850**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K: This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

Engineering Science Course (ESC/ ETC/ PLC) [L-T-P::3-0-0]			
22EC36A	Signals and Systems	22EC36C	Semiconductor Devices
22EC36B	Transmission Lines and Waveguides	22EC36D	Power Electronics
Ability Enhancement Course –III			
22ECAE381	Fundamentals of Computer System and Office	22ECAE383	
22ECAE382	Computer organization	22ECAE384	

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals 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. Form the regulation governing the Degree of Bachelor of Engineering/ Technology (B.E. / B. Tech.) 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 semesters 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 Department	Teaching Hours/Weeks				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self Study	Duration in Hours	SEE Marks	CIE Marks	Total Marks	
					L	T	P	S					
1	PCC	22EC41	Analog and Digital Communication	E & CE	3	0	0	-	03	50	50	100	3
2	IPCC	22EC42	Embedded Microcontrollers	E & CE	3	0	2	-	03	50	50	100	4
3	IPCC	22EC43	Digital Design using Verilog HDL	E & CE	3	0	2	-	03	50	50	100	4
4	PCCL	22ECL44	Analog and Digital Communication Lab	E & CE	0	0	2	-	03	50	50	100	1
5	ESC	22EC45A	Principles of Electromagnetics	E & CE	3	0	0	-	03	50	50	100	3
6	BSC	22BSC46	Biology for Engineers	E & CE	1	0	0	-	02	50	50	100	3
7	UHV	22UHV47	Universal Human Values Course	E & CE	0	0	2	-	02	50	50	100	1
8	AEC	22ECAE481	MATLAB for Engineers	E & CE	If the Course in Theory				03	50	50	100	1
					0	2	0	-					
					If the Course in Laboratory								
					0	0	2	-					
9	NCMC	22NS49	Mandatory Course	NSS Coordinator	0	2	2	-	-	50	-	50	0
		22PE49	Mandatory Course	Physical Education Director									
		22YO49	Mandatory Course	Yoga Teacher									
									Total	**450**	**400**	**850**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S=SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K: This letter in the course code indicates common to all the stream of engineering.
Engineering Science Course: The course is not common to all the departments and it is relevant to the respective departments.

Engineering Science Course(ESC/ETC/PLC)[L-T-P::3-0-0]

22EC45A	Principles of Electromagnetics	22EC45C	Communication Switching Circuits
22EC45B		22EC45D	
Ability Enhancement Course /Skill Enhancement Course IV			
22ECAE481	MATLAB for Engineers	22ECAE483	
22ECAE482		22ECAE484	

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/ Technology (B.E/ B. Tech.) 2022-23

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 semesters 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 courses is mandatory for the award of degree.

Engineering Mathematics-III(Electrical & Electronics Engineering Stream)			
Course Code	21MA31C	Credits	3
Course Type	Theory	CIE Marks	50
Lecture Hours(L:T:P)	3:0:0	SEE Marks	50
Total Hours	42	SEE Hours	03

Course Objectives: : To enable the students to obtain the knowledge of Engineering Mathematics in the following topics

- Z-transforms, Fourier Series, Fourier transforms and and its application in engineering fields
- Probability distribution of discrete and continuous random variables
- Joint probability distributions and discrete and continuous random variables

Modules-1	**Teaching Hours**
Difference equations and Z-Transforms : Difference equations –Basic definitions, Z Transform-Definitions, standard Z-transform, linearity property, damping rule, shifting rule , initial value theorem ,final value theorem. Inverse Z-Transform and applications.	**09**
Modules-2	
Fourier series: Periodic functions, Fourier series with periods $(0, 2\pi)$, $(-\pi, \pi)$, $(0, 2l)$ and $(-l, l)$. Half range Fourier series, Practical harmonic analysis and problems.	**08**
Modules-3	
Fourier Transform: Finite and Infinite Fourier transforms, Fourier sine and cosine transforms, properties, Inverse Fourier transforms and problems	**09**
Modules-4	
Probability distributions: Random variable (Discrete and continuous) p.d.f., c.d.f., Binomial distribution, Poisson distributions, Normal distribution and problems	**08**
Modules-5	
Joint probability distributions: Concept of joint probability distribution, discrete and continuous random variables independent random variables .problems on expectation and variance	**08**

Question paper pattern:

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note:There can be a maximum of 4 subsections in each Question.

Text books:

1 Higher Engineering Mathematics by B.S.Grewal, Khanna publishers; 40th Edition.2007

2 Engineering Mathematics by N. P. Bali and Manish Goyal. Laxmi publications, latest edition

Reference books:

1.Advanced Engineering Mathematics by E. Kreyszig, John Willey & sons 8th Edn.
2.A short course in differential equations – Rainvile E.D.9th Edition.
3.Advanced Engineering Mathematics by R.K.Jain & S.R.K Iyengar; Narosa publishing House.
4.Introductory methods of numerical analysis by S.S.Sastry
4. Statistical Methods Authored By Gupta S.P. Publisher: Sultan Chand & Sons. Publishing Year: 2021
5. Fundamentals of Mathematical Statistics Authored By Gupta S.C.& Kapoor V.K.Publisher: Sultan Chand & Sons. Publishing Year: 2020

E books and online course materials:

Course outcomes: On completion of the course, the student will have the ability to,

Course Code	**CO #**	**Course Outcome (CO)**
22MA31C	CO1	Understanding the characteristics and properties of the Z-transform
	CO2	Construction of Fourier series for periodic signals and Fourier series to analyze circuits.
	CO3	Determine Fourier transformation for continuous time signals and systems
	CO4	Solve problems using theoretical probability distributions
	CO5	Apply the concepts of joint probability, to find covariance, correlation, independent variables

ELECTRONIC CIRCUITS-I			
Course Code	22EC32	Credits	4
Course Type	Integrated	CIE Marks	50
Lecture Hours(L:T:P)	3:0:2	SEE Marks	50
Total Hours	42 (Theory)+13 (Lab Slots)	SEE Hours	03

Course Objectives: This course will enable the students to understand

- Various Applications of diode circuits
- Biasing of BJTs and FETs
- Design and analysis of BJT and FET
- Design and analysis of oscillators.
- Analysis of power devices

Modules-1	Teaching Hours
Diode characteristics: Introduction, load line analysis, diode approximations, series diode configuration with DC inputs, parallel and series configurations, Diodes applications: AND / OR gates, clippers, clampers, zener diodes as regulators and voltage multiplier circuits.	8
Modules-2	
Bipolar Junction transistor: Introduction, transistor construction, configurations and input output characteristics, Transistor biasing: operating point, fixed bias circuit, emitter stabilized bias circuits and voltage divider bias analysis. Small signal analysis: BJT transistor modelling and hybrid equivalent model of small signal amplifier configuration and deriving voltage gain, input impedance and output impedance.	9
Modules-3	
Power Amplifiers: Class A large signal amplifiers, second harmonic distortion Higher order harmonic generation, the transformer coupled audio power amplifier, efficiency, push pull amplifiers, class B and class C amplifiers. FET biasing: fixed bias configurations, self -bias configurations, voltage divider biasing. Small signal analysis: small signal model of JFET, FET amplifier design and analysis.	9
Modules-4	
Feedback and Oscillator circuits: Feedback concepts, Analysis of different feedback topologies, practical feedback circuits, feedback amplifier, phase and frequency considerations, Oscillators: operation, R C phase shift oscillator, Wien bridge oscillator, tuned oscillator circuits, crystal oscillator.	8
Modules-5	
Multilayer devices: SCR, DIAC and TRAIC characteristics and ratings, , UJT operation and characteristics. UJT as a fining circuit, Power Converters: half and full wave basic controlled rectifiers, step down and step up chopper, single phase half and full bridge inverters.	8

Question paper pattern:

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.
- Note: There can be a maximum of 4 subsections in each Question..

Text Books:

1. Robert L Boylestad, "Electronic Devices and Circuit Theory", 6 th edition 1999. PHI.
2. Miliman Halkias, "Electronic Devices and circuits", TMH
3. Muhammad H Rashid,"Power Electronics", 2 nd edition 2004, PHI

Reference Books:

1. Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", 6 th Edition, Oxford University Press, 2010.
2. David A.Bell, "Electronic Devices and Circuits", 5 th editon 2010, Oxford Higher Education Press.

E books and online course materials:

Course outcomes: On completion of the course, the student will have the ability to,

Course Code	CO #	Course Outcome (CO)
22EC32(IPCC)	CO1	Analyze and apply diode circuits for various applications.
	CO2	Design and analyze transistor biasing circuits and amplifiers.
	CO3	Analyze FET biasing circuits and amplifiers
	CO4	Analyze feedback amplifiers and design oscillators.
	CO5	Analyze and apply power devices for various applications.

LIST OF EXPERIMENTS:

1. Full-wave rectifier with/without capacitor filter.
2. Series and Parallel clipping circuits
3. Clamping circuits
4. Zener voltage regulator
5. Fixed-bias amplifier circuit using BJT.
6. Design and construct BJT CE amplifier using voltage divider bias with and without bypass emitter resistor.
7. Darlington amplifier
8. RC Phase shift oscillator using BJT.
9. Hartley and Colpitt's oscillator
10. Crystal oscillator
11. Design of a single stage voltage series feedback amplifier and draw frequency response.
12. Characteristics of SCR, UJT.
13. Step down chopper.

22EC32: Electronic Circuits-I

CO#	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Analyze and apply diode circuits for various applications.	3	3	1					2	3	1	3	1	3	2	2
CO2	Design and analyze transistor biasing circuits and amplifiers.	3	3	2					2	3	1	3	1	3	2	2
CO3	Analyze FET biasing circuits and amplifiers	3	3	2					2	3	1	3	1	3	2	2
CO4	Analyze feedback amplifiers and design oscillators.	3	3	3					2	3	1	3	1	3	2	2
CO5	Analyze and apply power devices for various applications.	3	3	2					2	3	1	3	1	3	2	2
Average		3	3	2					2	3	1	3	1	3	2	2

NETWORKS AND TRANSMISSION LINES			
Course Code	22EC33	Credits	4
Course Type	Integrated	CIE Marks	50
Lecture Hours(L:T:P)	3:0:2	SEE Marks	50
Total Hours	42 (Theory)+13 (Lab Slots)	SEE Hours	03

Course Objectives: This course will enable the students to understand

- To introduce loop, mesh analysis ,graph theory and analyze circuits in transient conditions
- To describe various network parameters and resonant circuits.
- To apply and analyze various network theorems in solving the problems related to electrical circuits.
- To describe various types of passive filters.
- To introduce transmission line fundamentals and lines at radio frequencies

Modules-1	Teaching Hours
Network Equations: Kirchhoff's laws, The number of network equations, Source transformation, examples of the formulation of network equations loop variable analysis, node variable analysis, Duality. Graph theory and equations.	9
Modules-2	
Transient Analysis: Capacitive and inductive transients and equivalent circuits, transients in RL, RC and RLC circuits, initial and final conditions, time constants. **Two Port Network Parameters:** Z, Y, ABCD, hybrid parameters, their inverse and image parameters, relationship between parameters.	8
Modules-3	
Resonance: Definition of Q, the factor of merit ,series resonance, bandwidth of the series resonant circuit, parallel resonance, conditions for maximum impedance, currents in anti-resonant circuits, impedance variation with frequency. **Theorems:** Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem and Reciprocity theorem.	8
Modules-4	
Filters: The neper, the decibel, Characteristic impedance of symmetrical network, Current and Voltage ratios as exponentials, The propagation constant, Filter fundamentals, Constant-K low pass and high pass filter. **Transmission Line Theory:** A line of cascaded T sections, the transmission line- general solution, physical signification of the equations; the infinite line, wavelength; velocity of propagation, waveform distortion, the distortionless line.	9
Modules-5	
Transmission Line Theory: Reflection on a line not terminated in Z_o , reflection co-efficient, open and short circuited lines. **The line at radio frequencies:** Constant for the line of zero dissipation, voltages and currents on the dissipation less line, standing waves; nodes;	9

standing- wave ratio, input impedance of the dissipation less line, the quarter wave line, impedance matching, single stub impedance matching on a line.	

Question paper pattern:

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.
- Note: There can be a maximum of 4 subsections in each Question..

Text books:

1. M. E. Van Valkanberg, "Network Analysis", PHI Third edition,2005
2. John D. Ryder, Networks, lines & fields, PHI second edition,2010

Reference Books:

1. Hayt. W. H. & J. E. Kemmerly, "Engineering Circuit Analysis", TMH Eighth edition JA r. Edminister, electromagnetic, TMH 2nd ed.
2. William D Stanley, "Network Analysis with Applications", Pearson Education Fourth edition, 2002.
3. Roy Choudhary D, "Network and systems", New age Publications First edition, Reprint 2005
4. Umesh sinha "Transmission lines & Network" Tech India publications fifth edition,1998

E books and online course materials: NPTEL

Course outcomes:
On completion of the course, the student will have the ability to:

Corse Code	CO #	Course Outcome (CO)
22EC33	CO1	Analyze and implement the networks using different methods.
	CO2	Carryout transient analysis of RL RC RLC circuits and also compute different two port network parameters.
	CO3	Analyze resonant circuits and circuit analysis by using different theorems,
	CO4	Analyze passive filters, to obtain the general solution of transmission lines
	CO5	Analyze the transmission lines at radio frequencies.

List of Experiments

1. Study of KCL, KVL
2. Network theorems:
   i) Thevenin's Theorem and Norton's Theorem
   ii) Superposition
   iii) Maximum power theorem
3. Resonance and tuned circuits
   i) Series resonance ii.Parallel resonance
4. Transient analysis
5. Steady state analysis
6. Measurement of impedance and admittance parameters of a two port network.
7. Filters
   i)low pass filter ii)high pass filter
8. Attenuators.

22EC33 (IPCC): Networks and Transmission Lines

CO#	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Analyze the networks using different methods.	3	2	1			1	1	2	3	2			3	2	2
CO2	Carryout transient analysis of RL RC RLC circuits and also compute different two port network parameters.	3	2	1			1	1	2	3	2			3	2	2
CO3	Analyze resonant circuits and circuit analysis by using different theorems,	3	2	1			1	1	2	3	2			3	2	2
CO4	Analyze passive filters, to obtain the general solution of transmission lines	3	2	1			1	1	2	3	2			3	2	2
CO5	Analyze the transmission lines at radio frequencies.	3	2	1			1	1	2	3	2			3	2	2
Average		3	2	1			1	1	2	3	2					2

DIGITAL ELECTRONICS			
Course Code	22EC34	Credits	3
Course Type	Theory	CIE Marks	50
Lecture Hours(L:T:P)	3:0:0	SEE Marks	50
Total Hours	42	SEE Hours	03

Course objectives: This course enables the students to

- Learn simplification of Boolean expressions, Combinational logic Design
- Learn design of Combinational circuits using MSI ICs.
- Learn design of Sequential circuits.
- Gain understanding of Analysis of Sequential circuits
- Learn fundamentals of Microprocessors.

Module-1	Teaching Hours
Combinational Logic Design: Introduction, Review of Boolean Algebra and Logic gates, Standard Representations for Logical Functions, Minimization of Logical Functions and realisation using gates - K-maps (upto 5 variables), Quine-McCluskey technique, VEM technique. Design examples(with gate realisation)-Arithmetic circuits, Adder with Look-Ahead Carry, BCD-to-7-segment Decoder.	10 Hours
Module-2	
Combinational Logic Design using MSI circuits: Multiplexers-Design examples, Applications, Mux Tree, Demultiplexers/Decoders-Design, Applications, BCD Adder, Digital Comparator, Code Converters-Bin-to-Gray and Gray-to-Binary, Priority Encoders: Decimal-to-BCD, Decoder/Driver for Display: BCD-to-7-segment Decoder/Driver.	08 Hours
Module-3	
Sequential Circuits : Introduction, A 1-bit memory Cell, Clocked S-R Flip-Flop, J-K FF, D-FF, T-FF. Excitation Table of FFs, Clocked FF Design, Edge-triggered FFs. Registers, Applications of Shift Registers-Ring Counter, Twisted-Ring Counter, Sequence Generator.	08 Hours
Module-4	
Sequential Circuits: Ripple/Asynchronous Counters-Design examples using T-FFs, JK-FFs, examples using MSI ICs-7493, 7490. Synchronous Counters-Design examples using FFs, Clocked Sequential Circuit Design, Analysis of Synchronous sequential circuits.	08 Hours
Module-5	
Fundamentals of Microprocessors: Introduction, An ideal MP, D-Bus, A-Bus, C-Bus, MP based System-Basic operation, MP operation, MP Architecture, Instruction Set, The 8085A MP, The 8086MP, Programming Languages.	08Hours

Question paper pattern:

- The question paper shall have five modules for 100 marks;

- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question..

Text Books:

1. R.P.Jain, " Modern Digital Electronics" 3th Edition, Tata McGraw-Hill Publ. Co. Ltd.
2. John. M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.

Reference Books:

1. M.Morris Mano,"Digital Design",4thEdn, PHI Pvt. Ltd,2008
2. Morris and Miller."Designing with TTL integrated circuits", McGrawHill
3. Fletcher, "An Engineering approach to Digital Design", PHI
4. Kohavi, "Switching and Finite Automata Theory",TMH

Course Outcomes: On completion of the course, the student will have the ability to,

Course Code	CO #	Course Outcome (CO)
22EC34	CO1	Apply different methods for simplification of Boolean expressions and realize using gates.
	CO2	Design and realize Combinational circuits using MSI ICs.
	CO3	Design and realize sequential circuits.
	CO4	Analyse Asynchronous sequential circuits.
	CO5	Analyse Microprocessor based systems

22EC34 : Digital Electronics

CO#	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Apply different methods for simplification of Boolean expressions and realize using gates.	3	2	3					1		1		1	3	3	2
CO2	Design and realize Combinational circuits using MSI ICs.	3	3	3					1		1		1	3	3	2
CO3	Design and realize sequential circuits.	3	3	3					1		1		1	3	3	2
CO4	Analyse Asynchronous sequential circuits.	3	3	3					1		1		1	3	3	2
CO5	Analyse Microprocessor based systems	1	1	2					1		1		1	3	3	2
Average		2.6	2.4	2.8					1		1		1	3	3	2

DIGITAL ELECTRONICS LABORATORY			
Course Code	22ECL35	Credits	1
Course Type	Practical	CIE Marks	50
Lecture Hours(L:T:P)	0:0:2	SEE Marks	50
Total Hours	13 Lab Slots	SEE Hours	03

Course objectives: This course will enable the students to

- Learn design, realize and practically implement Combinational logic circuits
- Learn design, realize and practically implement Combinational logic circuits-MSI ICs
- Learn design, realize and practically implement Sequential logic circuits-Counters
- Learn design, realize and practically implement Sequential logic circuits-Registers

1. Design and implementation of Adder and Subtractor using logic gates.
2. Design and implementation of code converters using logic gates
3. Design and implementation of 4 bit binary Adder/ subtractor and BCD adder using IC 7483
4. Design and implementation of 2 bit Magnitude Comparator using logic gates and 8 Bit Magnitude Comparator using IC 7485
5. Design and implementation of 16 bit odd/even parity checker generator using IC74180.
6. Design and implementation of Multiplexer and De-multiplexer using logic gates and realization Boolean functions using MSI MUX/DEMUX
7. Design and implementation of encoder and decoder using logic gates and realization Boolean functions using MSI Encoders/Decoder.
8. Design and realization of 2-bit, 3-bit and 4-bit ripple counters.
9. Design and implementation of synchronous counters.
10. Implementation of SISO, SIPO, PISO and PIPO shift registers using flip-flops.
11. Realization of ring counters using 7495 ICs.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and will be evaluated for 85% of the total marks.

Course outcomes: On completion of the course, the student will have the ability to,

Course Code	CO #	Course Outcome (CO)
22ECL35	CO1	Simplification of Boolean expressions and realization using gates.
	CO2	Design and realize Combinational circuits using MSI ICs.
	CO3	Design and realize Ripple/Asynchronous Counters.
	CO4	Design and realize Synchronous Counters.
	CO5	Design and realize Sequential circuits using Shift Registers.

22ECL35 : Digital Electronics Lab

CO#	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Simplification of Boolean expressions and realization using gates.	2	2	1			1	1	2	3	2		1	3	2	2
CO2	Design and realize Combinational circuits using MSI ICs.	3	3	1			1	1	2	3	2		1	3	2	2
CO3	Design and realize Ripple/Asynchronous Counters.	3	3	1			1	1	2	3	2		1	3	2	2
CO4	Design and realize Synchronous Counters.	3	3	1			1	1	2	3	2		1	3	2	2
CO5	Design and realize Sequential circuits using Shift Registers.	3	3	1			1	1	2	3	2		1	3	2	2
Average		2.6	2.8	2.8	1			1	1	2	3	2		1	3	2

SIGNALS AND SYSTEMS			
Course Code	22EC36A	Credits	1
Course Type	Theory	CIE Marks	50
Lecture Hours(L:T:P)	3:0:0	SEE Marks	50
Total Hours	13 Lab Slots	SEE Hours	03

Course Objectives: This course enables the students

- To understand basics of signals and systems, sampling theorem.
- To learn Linear Time Invariant systems and properties of LTI systems.
- To understand Fourier representation of Continuous Time signals.
- To understand Fourier representation of Discrete Time signals.
- To learn Transform and its applications.

Modules-1	Teaching Hours
Introduction: Continuous-Time and Discrete-Time signals, Transformation of the independent variable, exponential and sinusoidal signals, the unit impulse and unit-step functions, Continuous-Time and Discrete-Time systems, basic system properties.	**08**
Modules-2	
Linear Time-Invariant Systems: Discrete-time LTI systems, the convolution sum, continuous-time LTI systems, convolution integral, properties of LTI systems, causal LTI systems described by differential and difference equations, singularity functions.	**08**
Modules-3	
Fourier series representation of periodic signals: The response of LTI systems to complex exponentials, Fourier series representation of Continuous-Time periodic signals, convergence of the Fourier series, properties of Continuous-Time Fourier series, Fourier series representation of Discrete-Time periodic signals, properties of Discrete-Time Fourier series.	**09**
Modules-4	
Representation of aperiodic signals: Continuous-Time Fourier transform, the Fourier transform of periodic signals, properties Continuous-Time Fourier transform, the convolution and multiplication property, duality, the Discrete-Time Fourier transform, the Fourier transform of periodic signals, properties of Discrete-Time Fourier transform, the convolution and multiplication property, duality.	**09**
Modules-5	
Sampling: Representation Continuous-Time signals by its samples, the sampling theorem, Reconstruction of a signal from its samples using interpolation, aliasing. **Z-Transform:**The Z-Transform, region of convergence (ROC) and its properties, inverse Z-transform, properties of Z-transform, analysis and characterization of LTI systems using Z-Transforms, unilateral Z-transform.	**08**

Question paper pattern:

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question.

Text Books: 1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson Education, 2007.
Reference Books: 1. Simon Haykin and Barry Van Veen "Signals and Systems", John Wiley & Sons, 2001 2. Miichael J Roberts, Govind Sharma, "Fundamentals of Signals and Systems", 2nd Edition, McGrawHill 2010 3. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2005
E books and online course materials: NPTEL
Course outcomes: On completion of the course, the student will have the ability to,

Course Code	CO #	Course Outcome (CO)
22EC36A	**CO1**	Analyze different signals and operations on signals.
	CO2	Analyze LTI systems and determine properties of LTI systems.
	CO3	Analyze Continuous-Time signals in Fourier Domain
	CO4	Analyze Discrete-Time signals in Fourier domain.
	CO5	Analyze Discrete-Time signals using Z-Transform.

22EC36A : Signals and Systems

CO#	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Analyze different signals and operations on signals.	3	3	2										3	3	2
CO2	Analyze LTI systems and determine properties of LTI systems.	3	3	2										3	3	2
CO3	Analyze Continuous-Time signals in Fourier Domain	3	3	2										3	3	2
CO4	Analyze Discrete-Time signals in Fourier domain.	3	3	2										3	3	2
CO5	Analyze Discrete-Time signals using Z-Transform.	3	3	2										3	3	2
Average		2.6	3	3	2										3	3

BASIC COMPUTER SKILLS & MS-OFFICE			
Course Code	22ECAE381	Credits	1
Course Type	Practical	CIE Marks	50
Lecture Hours(L:T:P)	0:0:2	SEE Marks	50
Total Hours	13 Lab Slots	SEE Hours	03

Course objectives: The course will enable students

- To acquire basic knowledge about computer hardware and software.
- To be able to create documents for printing and sharing using MS-Word.
- To be able to create and share presentations using MS-PowerPoint.
- To be able to manage and store data in a spreadsheet using Ms-Excel.
- To familiarize the use of Internet and E-mail & computer communication and networks.

Modules-1	**Teaching Hours**
Introduction to computer and Basic data types Introduction to computer- Characteristics and Basic Applications of Computer, Components of Computer System, Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices, Memory, concepts of Hardware and Software, Classifications of computers; Representation of data/Information concepts of data processing, Basic data types, Storage of data/Information as files, operating system and The User Interface (windows, Linux), Windows Setting- Control Panels, Accessories (windows)	**05**
Modules-2	
Basic Word Processing Introduction to Word Processing, Opening Word Processing Package, Opening and closing documents, Using a Document/Help Wizard, Text Creation and Manipulation, Formatting the Text, Handling Multiple Documents, Table Manipulation, Printing, saving documents in different formats.	**06**
Modules-3	
Basic Presentations Basics- Difference between presentation and document, Using Power Point, Creation of Presentation, Preparation of Slides, Selection of type of Slides, Importing text from word documents, Providing aesthetics- Slide Designs, Slide Manipulation and Slide Show, Presentation of the Slides	**06**
Modules-4	
Spreadsheets and Basic Data Analysis Spread Sheet, Elements of Electronics Spread Sheet, Application/usage of Electronic Spread Sheet, Manipulation of cells, Formulas and functions; Spread sheets for Small accountings maintaining invoices/budgets, basic practical data analysis works (Maintaining daily and monthly sales reports)	**06**
Modules-5	
Basic Computer Communication and Internet Basic of Computer networks- LAN and WAN, Internet, Service on Internet; WWW and Web Browsers, Web Browsing software, Surfing the Internet, Chatting on Internet, Email-Basic of electronic mail, Using Emails, Document handling in Email	**05**

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20marks.

- There will be 2 full questions (with a maximum of four sub questions) from each module, there will be five modules.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text books:

1. C.S. French "Data Processing and Information Technology", BPB Publications 1998
2. P.K Sinha, Computer Fundamentals, BPB Publications, 1992

Reference Books:

1. Guy Hart-Davis "The ABCs of Microsoft Office 97 Professional edition", BPB Publications, 1998
2. Karl Schwartz, "Microsoft Windows 98 Training Guide", 1998

E books and online course materials:

1. Word : https://support.office.com/en-US/article/Word-2013-training-courses-videos-andtutorials-14807f76-d2b5-44d6-af11-9c880c44e551?ui=en-US&rs=en-US&ad=US
2. Excel: https://support.office.com/en-US/article/Excel-2013-training-courses-videos-andtutorials-aaae974d-3f47-41d9-895e-97a71c2e8a4a

Course outcomes: On completion of the course, the student will have the ability to,

Course Code	CO #	Course Outcome (CO)
22ECAE381	CO1	Describe and work with computer system
	CO2	Work in MS Word for project report drafting & Creating a Newsletter.
	CO3	Develop presentation in MS Power Point for seminar/project interactive presentation
	CO4	Apply formulas in MS Excel, creating charts and graphs to simplify complex information or data.
	CO5	Describe Internet Applications, E-mail Account & its Functions, utility of Search Engine and Surfing Web Pages

22ECAE381 : BASIC COMPUTER SKILLS & MS-OFFICE

CO#	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Describe and work with computer system	3	3	3					1				1	3	2	2
CO2	Work in MS Word for project report drafting & Creating a Newsletter.	3	3	3					1				1	3	2	2
CO3	Develop presentation in MS Power Point for seminar/project interactive presentation	3	3	2					1				1	3	2	2
CO4	Apply formulas in MS Excel, creating charts and graphs to simplify complex information or data.	3	3	2					1				1	3	2	2
CO5	Describe Internet Applications, E-mail Account & its Functions, utility of Search Engine and Surfing Web Pages	3	3	2					1				1	3	2	2
Average																

Syllabus IV Semester

Analog and Digital Communication		
Subject Code	22EC41	CIE: 50
Number of Lecture Hours/Week	3 (Theory)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
CREDITS- 3:0:0:3		

Course Objectives:

The objectives of the course is to enable students to:

1. To introduce the concepts of analogue communication systems.
2. To equip students with various issues related to analogue communication such as modulation, demodulation.
3. Understand different PCM techniques and its analysis in terms of SNR.
4. Understand different carrier modulation techniques and its BER performance.
5. To study and understand properties of orthogonal codes and its use in spread spectrum communication

Modules-1	Teaching Hours
Amplitude Modulation: Amplitude modulation, double sideband, double sideband suppressed carrier modulation, SSB modulation, vestigial sideband modulation, costas receiver, quardrature-amplitude modulation.	**10**
Modules-2	
Angle Modulation: Basic definitions, properties of angle-modulated waves, relationship between PM and FM waves, narrow-band frequency modulation, wide-band Frequency Modulation, transmission bandwidth of FM waves, generation of FM waves, demodulation of FM signals **Radio Receivers**: Tuned radio frequency receiver, super heterodyne receiver- RF section, frequency mixers, tracking, intermediate frequency, AGC.	**11**
Modules-3	
Pulse Modulation systems: Pulse amplitude modulation (PAM), Pulse width modulation(PWM) and Pulse position modulation(PPM). Bandwidth requirements, generation and reconstruction methods, Analog to digital conversion, quantization and encoding techniques, quantization noise in PCM, Companding in PCM systems, Time division multiplexing (TDM), The delta modulator and its operation, quantization noise and slope overload in delta modulators. Comparison of delta modulation and PCM.	**11**
Modules-4	
Digital Modulation: PSK, DPSK and FSK. M-array data communication systems,	**10**

QAM systems, four phase PSK effects of noise in modulated digital communication Systems, Probability of error expression for binary communications, probability of error in QAM systems, comparison of digital modulation systems.	
Modules-5	
Spread Spectrum Systems: PN sequence, PN sequence generation, Properties of PN sequence, Direct sequence Spread spectrum, Slow and fast Frequency hopping, Time hopping, Signal space dimensionality and processing gain, antijam characteristics, CDMA Applications, comparison of spread spectrum communication.	**10**

Question paper pattern:

• The question paper will have ten questions.

• Each full question consists of 20 marks.

• There will be 2 full questions (with a maximum of four sub questions) from each module.

• Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Simon Haykin, 'Introduction to Analog and Digital Communications', Second Edition.
2. Herbert Taub, Donald L.Schiling, 'Principles of Communication Systems', Second Edition.

Reference Books:

1. Simon Haykin, Digital Communications, John Wiley and Sons.
2. H.P.Hsu , Analog and Digital Communications, Schuam's outline series.
3. J G Proakis, Digital communications, MH.
4. B P Lathi, Modern Digital and Analog Communication, 3rd Edition.

E books and online course materials:

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
22EC41	CO1	Analyze different amplitude modulation and demodulation techniques.
	CO2	Analyze different angle modulation and demodulation techniques.
	CO3	Analyze different PCM techniques and its analysis in terms of SNR
	CO4	Analyze different carrier modulation techniques and its BER performance
	CO5	Analyze properties of orthogonal codes and its use in spread spectrum communication.

22EC41: ANALOG AND DIGITAL COMMUNICATION

CO#	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Analyze different amplitude modulation and demodulation techniques.	3	2	2	2				1		1		1	3	2	2
CO2	Analyze different angle modulation and demodulation techniques.	3	3	2	2				1		1		1	3	2	2
CO3	Analyze different PCM techniques and its analysis in terms of SNR	3	3	2	2				1		1		1	3	2	2
CO4	Analyze different carrier modulation techniques and its BER performance	3	3	2	2				1		1		1	3	2	2
CO5	Analyze properties of orthogonal codes and its use in spread spectrum communication.	3	2	2	2				1		1		1	3	2	2
Average			3	2.6	2	2				1		1		1	3	2

EMBEDDED MICROCONTROLLERS			
Course Code	22EC42	Credits	4
Course Type	Integrated	CIE Marks	50
Lecture Hours(L:T:P)	3:0:2	SEE Marks	50
Total Hours	42 (Theory)+13 (Lab Slots)	SEE Hours	03

Course Objectives: The course will enable the students to,

- Study the architecture of 8051 microcontrollers
- Study addressing modes instruction sets, timers and counters to program with 8051
- Understand interrupt programming and real world interfacing with 8051
- Study architecture of ARM Cortex M series and TM4C
- Study ARM fundamentals for basic programming

Module-1	Teaching Hours
The 8051 Microcontrollers: Micro-controllers and Embedded Processors, Overview of the 8051 Family, Inside the 8051 8051 Programming: Pin diagram, Introduction to 8051 Assembly Programming, Assembling and Running an 8051 Program. The Program Counter and ROM Space in the 8051, Data Types and Directives. 8051 PSW Register, RAM organization, Stack.	8 Hours
Module-2	
Addressing Modes, Instruction Sets: Data transfer, Arithmetic, Logical, Bit, Branch instructions. 8051 Timer and Counter Programming: TMOD and TCON register, Programming 8051 Timers, Counter Programming.	8 Hours
Module-3	
Interrupt Programming: 8051 Interrupts, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupt, Interrupt Priority in the 8051. Real World Interfacing: 8051 Interfacing to LCD, Keyboard, ADC/DAC, stepper motor.	9 Hours
Module-4	
Introduction to Embedded system: Introduction to ARM architecture and Cortex – M4F processor, Cortex M4F architecture, Features.TM4C123GH6PM Block diagram, Features, Applications, TM4C123GH6PM launch pad I/O ports, Address space, On-chip peripherals (analog and digital), Register sets, Addressing modes and Instruction set basics.	7 Hours
Module-5	
Microcontroller fundamentals for basic programming: I/O pin multiplexing, pull up/down registers, GPIO control, Programming System registers, Watchdog Timer, QEI. Applications Based on TIVA: LED Blinking, Interrupt programming through GPIO, PWM generation, Interfacing potentiometer (ADC) with TIVA GPIO.	8 Hours

Text Books:

1. The 8051 Microcontrollers and Embedded Systems, MAZIDI and MAZIDI, Second edition, Pearson Education,1999
2. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, 2014, Create space publications ISBN: 978-1463590154.
3. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition Jonathan W Valvano, Create space publications ISBN-13: 978-1477508992

Reference Books:

1. The 8051 Microcontroller, Kenneth Ayala, Second Edition, Thomson,2006
2. The Definitive Guide to ARM® Cortex®-M3, Second Edition, 2017 November, Joseph Yui.
3. CC3100/CC3200 Simple Link™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015.

Question paper pattern:

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question..

List of Experiments/ Programs

Programming 8051 using Keil µVision

1. Develop programs using data movement instructions and arithmetic instructions
2. Develop programs on logical, bit manipulation instructions
3. Develop programs on branch and loop instructions
4. Programs 8051 timers and counters to perform specific functions
5. Develop programs to perform code conversions
6. Program 8051 to execute subroutine call and interrupts

Programming Tiva C series TM4Cxx module with CC Studio.

7. Interfacing and Programming GPIO ports in 'C' using Tiva(LED Blinking and Push Button)
8. Interrupt programming through GPIO
9. PWM generation using PWM module on Tiva
10. Interfacing Potentiometer with Tiva GPIO

Course outcomes: On completion of the course, the student will have the ability to,

Course Code	CO #	Course Outcome (CO)
22EC42	CO1	Describe the 8051 microcontroller architecture, PSW and memory
	CO2	Analyze the working of 8051 timers and counters and program using 8051.
	CO3	Perform interrupt programming and Interface 8051 with real world I/O devices
	CO4	Describe the architecture of ARM and TM4C microcontroller and program for basic operations
	CO5	Analyze the TM4C modules and Program TM4C to interface real world modules

22EC42: Embedded Microcontrollers

CO#	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Describe the 8051 microcontroller architecture, PSW and memory	3	3	3		3				3			2	3	2	2
CO2	Analyze the working of 8051 timers and counters and program using 8051.	3	3	3		3				3			2	3	2	2
CO3	Perform interrupt programming and Interface 8051 with real world I/O devices	3	3	3		3				3			2	3	2	2
CO4	Describe the architecture of ARM and TM4C microcontroller and program for basic operations	3	3	3		3				3			2	3	2	2
CO5	Analyze the TM4C modules and Program TM4C to interface real world modules	3	3	3		3				3			2	3	2	2
Average		3	3	3		3				3			2	3	2	2

DIGITAL DESIGN USING VERILOG HDL			
Course Code	22EC43	Credits	4
Course Type	Integrated	CIE Marks	50
Lecture Hours(L:T:P)	3:0:2	SEE Marks	50
Total Hours	42 (Theory)+13 (Lab Slots)	SEE Hours	03

Course Objectives: The Course will enable students to,

- Learn different Verilog HDL constructs.
- Familiarize the different levels of abstraction in Verilog.
- Understand Verilog Tasks and Directives.
- Understand timing and delay Simulation.
- Understand logic synthesis using Verilog.

Module-1	**Teaching Hours**
Overview of Digital Design with Verilog HDL: Evolution of CAD, Emergence of HDLs, Typical HDL-flow, Why Verilog HDL?, Trends in HDLs. Top-down and bottom-up design methodology, Lexical conventions, Structure of Verilog HDL module, Levels of abstraction.	07 Hours
Modules-2	
Operators and Data types, Dataflow Modelling: Continuous assignments, delay specification, expressions, Structure of Dataflow description, Examples.	08 Hours
Modules-3	
Behavioural Modelling**:** Structured procedures, initial and always, blocking and non blocking statements, delay control, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks.	09 Hours
Modules-4	
Gate-Level Modelling: Modelling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. Tasks and Functions: Differences between tasks and functions, declaration, invocation, automatic tasks and functions.	07 Hours
Modules-5	
Useful Modeling Techniques**:** Procedural continuous assignments, overriding parameters, conditional compilation and execution, useful system tasks. Logic Synthesis with Verilog: Logic Synthesis, Impact of logic synthesis, Verilog HDL Synthesis, Synthesis design flow, Synthesis information from Entity and Module, Mapping Process and Always in the Hardware Domain	09 Hours

Text Books:

1. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, Pearson Education, Second Edition.
2. Nazieh M Botros, “HDL Programming – VHDL and Verilog”, Dreamtech Press, 2006 Edition.

Reference Books:

1. Donald E. Thomas, Philip R Moorby, 'The Verilog Hardware Description Language", Springer Science+ Business Media, LLC, Fifth edition.
2. Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL", Pearson (Prentice Hall), Second edition.
3. Padmanabhan, Tripura Sundari, "Design through Verilog HDL", Wiley, 2016 or earlier.

Question paper pattern:

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question..

List of Laboratory Experiments

1. Develop a Verilog code for all basic gates in all the modelling styles.
2. Develop a Verilog code for different combinational circuits (half adder, half subtractor, 2:1 multiplexer, 1:2 demultiplexer, 4:2 encoder and 2:4 decoder).
3. Develop a Verilog code for 1-bit full adder and full subtractor in all the modelling styles.
4. Develop a Verilog code for 4-bit full adder and full subtractor.
5. Develop a Verilog code for code conversion (binary to gray, gray to binary, binary to BCD, BCD to binary).
6. Develop a Verilog code for 8-bit, 16-bit and 32-bit ALU.
7. Develop a Verilog code for clock generation.
8. Develop a Verilog code for flip flops (SR, JK, D, T and Master Slave).
9. Develop a Verilog code for 4-bit counters (binary, BCD, Ring, Johnson).
10. Develop a Verilog code for 4-bit Bidirectional Shift Register.
11. Develop a Verilog code for calculation of a factorial of a number using task and function.

Course outcomes: On completion of the course, the student will have the ability to,

Course Code	CO #	Course Outcome (CO)
22EC43	CO1	Understand the basics of Verilog HDL Programming
	CO2	Develop programs in Data flow modelling using various data types and operators
	CO3	Develop programs to demonstrate behavioural modelling using conditional statements and loops.
	CO4	Develop programs in gate-level modelling using delays and using tasks and functions
	CO5	Perform timing and delay simulation and interpret the various constructs in logic synthesis.

22EC43: Digital Design Using Verilog HDL

CO#	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Describe the design flow and structure of Verilog HDL Programming	3	2	2	2			2		2		2	3	2	2	3
CO2	Develop programs with Data flow modelling by applying different data types and operators	3	3	3	3			2		2		2	3	3	2	3
CO3	Develop programs to demonstrate behavioural modelling using conditional statements and loops.	3	3	3	3			2		2		3	3	3	3	3
CO4	Develop programs in gate-level modelling using delays and using tasks and functions	3	3	3	3			3		2		3	3	3	3	3
CO5	Perform timing and delay simulation and interpret the various constructs in logic synthesis.	3	3	3	3			2		3		3	3	2	2	3
Average		3	2.8	2.8	2.8			2.2		2.2		2.6	3	2.6	2.4	3

Analog & Digital Communication Lab			
Course Code	22ECL44	Credits	1
Course Type	Practical	CIE Marks	50
Lecture Hours(L:T:P)	0:0:2	SEE Marks	50
Total Hours	13 Lab Slots	SEE Hours	03

Course Objectives:

The objectives of the course is to enable students to:

6. To design and demonstrate second order active low pass, high pass, band pass filters
7. To design and demonstrate analog and angle modulation.
8. To design and demonstrate pulse modulation and demodulation.\
9. To design and demonstrate digital modulation and demodulation such ASK, PSK, DPSK and FSK.
10. To verify and demonstrate PN sequence generation.

- Second order active low pass and high pass filter
- Second order active band pass and band elimination filter
- Amplitude modulation and demodulation using envelop detector
- Frequency modulation and demodulation using PLL
- Pre-emphasis and De-emphasis circuits.
- PAM modulation and demodulation
- PPM Modulation and demodulation
- PWM Modulation and demodulation
- Signal sampling and its reconstruction
- Time division multiplexing of signals
- Amplitude shift keying
- Frequency shift keying
- Phase shift keying
- Differential phase shift keying
- PN sequence generator

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and will be evaluated for 85% of the total marks.

Course outcomes: On completion of the course, the student will be able to:

Course Code	CO #	Course Outcome (CO)
22ECL44	CO1	Design various second order active filters.
	CO2	Design AM, FM and its demodulation.
	CO3	Design pre-emphasis and de-emphasis.
	CO4	Design and implement ASK, FSK and PSK modulation and demodulation.
	CO5	Design and implement PN sequence generator.

22ECL44: Analog and Digital Communication Lab

CO#	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Design various second order active filters.	3	2	2	2	2	1	1	2	3	2		1	3	3	2
CO2	Design AM, FM and its demodulation.	3	2	2	2	2	1	1	2	3	2		1	3	3	2
CO3	Design pre-emphasis and de-emphasis.	3	2	2	2	2	1	1	2	3	2		1	3	3	2
CO4	Design and implement ASK, FSK and PSK modulation and demodulation.	3	2	2	2	2	1	1	2	3	2		1	3	3	2
CO5	Design and implement PN sequence generator.	3	2	2	2	2	1	1	2	3	2		1	3	3	2
Average		3	2	2	2	2	1	1	2	3	2		1	3	3	2

PRINCIPLES OF ELECTROMAGNETICS			
Course Code	22EC45A	Credits	3
Course Type	Theory	CIE Marks	50
Lecture Hours(L:T:P)	3:0:0	SEE Marks	50
Total Hours	42	SEE Hours	03

Course Objectives: The course will enable the students,

- To appreciate the theory of vector analysis
- To understand the concepts of electrostatics, electrical potential, energy density and their applications
- To analyze the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications
- To explore Biot-Savart'sLaw, Ampere's Law, Faraday's Laws, and Maxwell's equations

Module-1	Teaching Hours
Preliminaries: Vector analysis and coordinate transformation: vector algebra, coordinate systems, vector components, unit vector, dot &cross products. Cylindrical and spherical, coordinate system, coordinate transformations. **Coulomb's law electric field intensity**: Experimental coulombs law, electric field intensity, electric field due to continuous volume charge, line charge, sheet charge. Electric flux density, Gauss law and Divergence: electric flux density, Gauss law and its applications, divergence theorem	9
Module-2	
Energy and potential: Energy and potential in a moving point charge in an electric field, line integral, potential difference and potential, potential field of a point charge, The potential field of a system of charges- conservative property, potential gradient, the dipole, energy density in electric field. **Conductors, dielectric and capacitance**: Current and current density, continuity of current, Metallic conductors, conductor properties and boundary conditions, Capacitance, several capacitance examples. Capacitance of a two- wire line	8
Module-3	
Poisson's and Laplace's equation: Poisson's and Laplace's equations, Uniqueness theorem, solution of Laplace's equation, examples of solutions of Poisson's equations. **Magnetic Fields:** Steady Magnetic fields: Biot savart's law, Ampere's circuital law, Curl. Stokes theorem, magnetic flux and flux density, Magnetic forces, material and inductances: Scalar and vector magnetic potentials, magnetic force between differential current elements, force and torque on a closed circuit, magnetic boundary conditions , magnetic circuit, inductance.	8
Module-4	
Time varying fields and Maxwell's equations: Faraday's law, displacement current, Maxwell's equations in point form and integral form, the retarded potentials. **Uniform plane wave**: Wave propagation in free space, wave propagation in dielectrics, The Poynting vector& power considerations, propagation in good conductors-skin effect, wave polarization, the distortion less line.	9
Module-5	
Plane waves at boundaries & in dispersive media: Reflection of uniform plane waves at normal incidence, standing wave ratio, wave reflection from multiple interfaces, plane wave propagation in general directions, plane wave reflection at oblique incidence angles, plane wave propagation in dispersive media.	8

Question paper pattern:

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question..

Text books:

1. William H Hayt Jr and John A Buck., Engineering electromagnetic,TMH7thed.

Reference Books:

1. Kraus J D and Carver K R., electromagnetic.,(TMH)
2. JA r. Edminister, electromagnetic, TMH 2nd ed.
3. P.N.O Sadiku,"Elementsofelectromagnetic"4th ed. Oxford University press.
4. E C Jordon & K G . Balmain., electromagnetic waves and radiation system., PHI2nd ed.Hayt. W. H. & J. E. Kemmerly, "Engineering Circuit Analysis", TMH Eighth edition JA r. Edminister, electromagnetic, TMH 2nd ed.

E books and online course materials:

Course outcomes: On completion of the course, the student will have the ability to,

Course Code	CO #	Course Outcome (CO)
22EC45A	CO1	Compute electric field intensity & potential using Coulomb's law & Gauss's law.
	CO2	Analysis of EM field using boundary conditions
	CO3	Analysis of steady magnetic fields.
	CO4	Analysis of time varying fields using Maxwell's equations and wave propagation in different media.
	CO5	Analysis of wave reflection in different media

22EC45A: Principles of Electromagnetics

CO#	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Compute electric field intensity & potential using Coulomb's law & Gauss's law.	3	3	2					1		1		1	3	2	2
CO2	Analysis of EM field using boundary conditions	3	3	2					1		1		1	3	2	2
CO3	Analysis of steady magnetic fields.	3	3	2					1		1		1	3	2	2
CO4	Analysis of time varying fields using Maxwell's equations and wave propagation in different media.	3	3	2					1		1		1	3	2	2
CO5	Analysis of wave reflection in different media	3	3	2					1		1		1	3	2	2
Average		3	3	2					1		1		1	3	2	2

BIOLOGY FOR ENGINEERS			
Course Code	22BSC46	Credits	3
Course Type	Theory	CIE Marks	50
Lecture Hours(L:T:P)	3:0:0	SEE Marks	50
Total Hours	42	SEE Hours	03

Course Objectives: The Course will enable the students to,

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

Modules-1	Teaching Hours
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 cell s 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.	08
Modules-2	
BIOMOLECULES ANDTHEIR APPLICATIONS(QUALITATIVE): Carbohydrates(cellulose- based water filters, PHA and PLA as bioplastics), Nucleicacids(DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics– DNA finger printing), 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).	08
Modules-3	
HUMAN ORGAN SYSTEMS AND BIODESIGNS(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 signaling -ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pacemakers, 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).	09
Modules-4	
NATURE-BIO INSPIRED MATERIALS AND MECHANISMS(QUALITATIVE): Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying(GPS and aircrafts), Lotus leaf effect (Super	08

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).	
Modules-5	
TRENDS IN BIO ENGINEERING(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).	09

Question paper pattern:

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question..

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
22ECAE481	CO1	Elucidate the basic biological concepts via relevant industrial applications and case studies.
	CO2	Evaluate the principles of design and development, for exploring novel bioengineering projects.
	CO3	Corroborate the concepts of biomimetics for specific requirements.
	CO4	Think critically towards exploring innovative bio-based solutions for socially relevant problems.
	CO5	

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 GeethaA 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

22BSC46: Biology for Engineers

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

MATLAB FOR ENGINEERS			
Course Code	22ECAE481	Credits	1
Course Type	Practical	CIE Marks	50
Lecture Hours(L:T:P)	0:0:2	SEE Marks	50
Total Hours	13 Lab Slots	SEE Hours	03

Course Objectives: The Course will enable the students to,

- The objectives of the course is to enable students to:
- Write MATLAB programs using built in functions.
- Write code to sketch plots.

Modules-1	Teaching Hours
Introduction, basic features, a minimum MATLAB session, getting started	02
Modules-2	
Mathematical functions, basic plotting, matrix generation	03
Modules-3	
Array operations, solving linear equations, matrix functions	03
Modules-4	
Introduction to programming in Matlab, M-file scripts, M-file functions, input to a script file, output commands.	03
Modules-5	
Control flow and operators, saving output to a file, debugging M-files	03

Question paper pattern:

- The question paper shall have five modules for 100 marks;
- Each full question carries 20 marks.
- Two questions to be set in each module (total ten questions).
- The candidate will have to answer one full question from each module.

Note: There can be a maximum of 4 subsections in each Question..

Text Books:

1. David Houcque, " Introduction To Matlab For Engineering Students"

Reference Books:

1. Brian H Hahn, Daniel T Valentine, "Essential MATLAB for Engineers and scientists"

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
22ECAE481	CO1	Start using MATLAB
	CO2	Use mathematical functions and plot
	CO3	Use array functions and matrix functions
	CO4	Do programming using MATLAB
	CO5	Use flow control functions and know how debug.

22ECAE481: MATLAB For Engineers

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