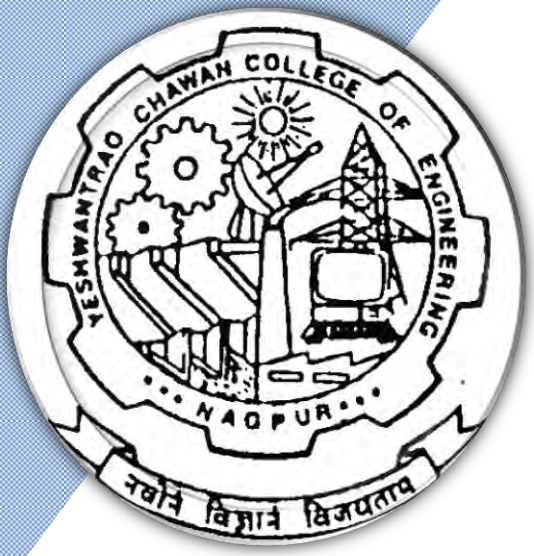
Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology

SoE & Syllabus 2020

3rd to 8th Semester

Electronics Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
TOTAL FIRST & SECOND SEM										47				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	EE2201	Electronic Devices	T	3	1	0	4	4	30	20	50	3 Hours
3	3	PC	EE2202	**Lab:**Electronic Devices	P	0	0	2	2	1		60	40	
4	3	PC	EE2203	Signal and Systems	T	3	0	0	3	3	30	20	50	3 Hours
5	3	PC	EE2204	**Lab**:Programming Language	P	0	0	2	2	1		60	40	
6	3	PC	EE2205	Digital Logic Design	T	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	EE2206	**Lab:** Digital Logic Design	P	0	0	2	2	1		60	40	
8	3	PC	EE2207	Network Analysis	T	3	0	0	3	3	30	20	50	3 Hours
9	3	PC	EE2208	**Lab:**Network Analysis	P	0	0	2	2	1		60	40	
					TOTAL	**15**	**1**	**8**	**24**	**20**				
Fourth Semster														
1	4	BS	GE2204	Advance Mathematical Techniques	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	EE2251	Electronic Circuits	T	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	EE2252	**Lab:**Electronic Circuits	P	0	0	2	2	1		60	40	
4	4	PC	EE2253	Microcontroller and its Applications	T	3	0	0	3	3	30	20	50	3 Hours
5	4	PC	EE2254	**Lab:** Microcontroller and its Applications	P	0	0	2	2	1		60	40	
6	4	PC	EE2255	Analog Communication	T	3	0	0	3	3	30	20	50	3 Hours
7	4	PC	EE2256	**Lab**.: Analog Communication	P	0	0	2	2	1		60	40	
8	4	PC	EE2257	Electromagnetic Fields	T	3	1	0	4	4	30	20	50	3 Hours
9	4	PC	EE2258	**Lab**: Simulation Lab/Workshp Lab	P	0	0	2	2	1		60	40	
					TOTAL	**15**	**1**	**8**	**24**	**20**				
Audit Courses														
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT	A	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS	AU2125	YCCE Communication Aptitude Preparation (YCAP4.2) for EL,EE,ET	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.05	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

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Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	EE2301	Digital Signal Processing	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	EE2302	**Lab:** Digital Signal Processing	**P**	0	0	2	2	1		60	40	
4	5	PC	EE2303	Analog Integrated Circuit & its Application	**T**	3	0	0	3	3	30	20	50	3 Hours
5	5	PC	EE2304	**Lab:** Analog Integrated Circuit & its Application	**P**	0	0	2	2	1		60	40	
6	5	PE		Professional Elective-I	**T**	3	0	0	3	3	30	20	50	3 Hours
7	5	PE		Lab.: Professional Elective-I	**P**	0	0	2	2	1		60	40	
8	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3 Hours
9	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3 Hours
10	5	STR	EE2310	**Industry Visit and its report**	**P**	0	0	0	0	1		100		
				TOTAL		**18**	**0**	**6**	**24**	**22**				

List of Audit Courses														
1	5	HS	AU2127	YCCE Communication Aptitude Preparation (YCAP5.2) for EL,EE,ET	**A**	3	0	0	3	0				

Professional Electives -I

1	5	PE-I	EE2311	PE-I:Computer Communication Network
2	5	PE-I	EE2312	**Lab:**PE-I:Computer Communication Network
3	5	PE-I	EE2313	PE-I:Embedded System
4	5	PE-I	EE2314	**Lab:**PE-I:Embedded System
5	5	PE-I	EE2315	PE-I:Algorithm & Data Structure
6	5	PE-I	EE2316	**Lab:**PE-I:Algorithm & Data Structure
7	5	PE-I	EE2317	PE-I: Applied Machine Learning
8	5	PE-I	EE2318	**Lab:**PE-I:Applied Machine Learning

Open Electives -I

1	5	OE-I	EE2331	OE I : Fuzzy Logic & Neural Network
2	5	OE-I	EE2332	OE I : Basics of Analog and Digital Communication
3	5	OE-I	EE2333	OE I : Biomedical Instrumentation

Open Electives -II

1	5	OE-II	EE2341	OE II : Data Acquisition & Signal Conditioning
2	5	OE-II	EE2342	OE II : Microprocessor Programming
3	5	OE-II	EE2343	OE II : Consumer Electronics

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TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.05
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

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SoE No. EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	EE2351	Control System Engineering	**T**	3	0	0	3	3	30	20	50	3 Hours
3	6	PC	EE2352	Transmission Lines and Waveguides	**T**	3	0	0	3	3	30	20	50	3 Hours
4	6	PC	EE2353	Digital Communication	**T**	3	0	0	3	3	30	20	50	3 Hours
5	6	PC	EE2354	**Lab:**Digital Communication	**P**	0	0	2	2	1		60	40	
6	6	PE		Professional Elective-II	**T**	3	0	0	3	3	30	20	50	3 Hours
7	6	PE		**Lab.:** Professional Elective-II	**P**	0	0	2	2	1		60	40	
8	6	OE		Open Elective - III **	**T**	3	0	0	3	3	30	20	50	3 Hours
9	6	OE		Open Elective - IV **	**T**	3	0	0	3	3	30	20	50	3 Hours
				TOTAL		**21**	**0**	**4**	**25**	**23**				

Professional Electives -II

1	6	PE II	EE2361	PE II:Internet of Things
	6	PE II	EE2362	**Lab:** PE II:Internet of Things
2	6	PE II	EE2363	PE II:Digital CMOS Circuits
	6	PE II	EE2364	**Lab:** PE II:Digital CMOS Circuits
3	6	PE II	EE2365	PE II:Digital Image Processsing
	6	PE II	EE2366	**Lab:**PE II:Digital Image Processsing
4	6	PE II	EE2367	PE II:Object Oriented Programming
	6	PE II	EE2368	**Lab:**PE II:Object Oriented Programming

Open Electives -III

1	6	OE-III	EE2381	OE III : Fuzzy Logic & Neural Network
2	6	OE-III	EE2382	OE III : Basics of Analog and Digital Communication
3	6	OE-III	EE2383	OE III : Biomedical Instrumentation
Open Electives -IV				
4	6	OE-IV	EE2391	OE IV : Data Acquisition & Signal Conditioning
5	6	OE-IV	EE2392	OE IV : Microprocessor Programming
6	6	OE-IV	EE2393	OE IV : Consumer Electronics

Audit Courses											
1	6	HS	AU2129	YCCE Communication Aptitude Preparation (YCAP6.2) for ME, EE, ETC	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.05
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

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SoE No. EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	EE2401	Digital System Design	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	EE2402	**Lab.**: Digital System Design	**P**	0	0	2	2	1		60	40	
3	7	PE		Professional Elective-III	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PE		Professional Elective-IV	**T**	3	0	0	3	3	30	20	50	3 Hours
5	7	PE		Lab. : Professional Elective-IV	**P**	0	0	2	2	1		60	40	
6	7	PE		Professional Elective-V	**T**	3	0	0	3	3	30	20	50	3 Hours
7	7	PE		Professional Elective-VI	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	STR	EE2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	EE2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -III

1	7	PE III	EE2411	PE III: Switching Theory & Finite Automata
2	7	PE III	EE2412	PE III :Power Electronics
3	7	PE III	EE2413	PE III: Wireless Sensor Network
4	7	PE III	EE2414	PE III: VLSI Signal Processing

Professional Electives -IV

1	7	PE IV	EE2421	PE IV: Wireless Communication
	7	PE IV	EE2422	**Lab:** PE IV:Wireless Communication
2	7	PE IV	EE2423	PE IV: RF and Microwave
	7	PE IV	EE2424	**Lab:** PE IV: RF and Microwave
3	7	PE IV	EE2425	PE IV: Analog VLSI Design
	7	PE IV	EE2426	**Lab. :** PE IV: Analog VLSI Design
4	7	PE IV	EE2427	PE IV: Operating Systems
	7	PE IV	EE2428	**Lab:** PE IV:Operating Systems

Professional Electives -V

1	7	PE V	EE2431	PE V: Industrial Automation
2	7	PE V	EE2432	PE V: Nano Electronics
4	7	PE V	EE2433	PE V: Optical Communication
5	7	PE V	EE2434	PE V: RF Circuit Design

Professional Electives -VI

1	7	PE-VI	EE2441	PE-VI: E-Commerce and Data Analytics
2	7	PE-VI	EE2442	PE-VI: Micro Electro Mechanical Systems (MEMS)
3	7	PE-VI	EE2443	PE-VI: Biomedical Instrumentation
4	7	PE-VI	EE2444	PE-VI: Computer Organization
5	7	PE-VI	EE2445	PE VI : Introduction to Remote Sensing and Image Analysis

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TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.04**	**Applicable for AY 2022-23 Onwards**
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SoE No. EE-202.1

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(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	EE2451	Major Project	P	0	0	12	12	9		60	40	
2	8	STR	EE2452	Extra curricular Activity Evaluation	P	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**84**	**2**	**46**	**132**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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Bachelor of Technology

SoE & Syllabus 2020

3rd Semester

Electronics Engineering

III Semester
GE2201 - Engineering Mathematics III

Objectives	Outcomes
1. Able to find numerical solution of various mathematical equations 2. Give knowledge of Laplace transform, Z transform, Fourier transform 3. Define the periodic functions in the form of Fourier series 4. Solve partial differential equations	The student will be able to: 1. Estimate the Calculus of Numerical Function. 2. Determine transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations. 3. Discuss the nature of periodic function and express it in terms of series. 4. Use appropriate method/s to solve partial differential equations.

Unit I: Finite Differences
Difference table; Operators E and Δ, Central differences, Factorials notation, Numerical differentiation and integration, Difference equations with constant coefficients. **(6 hours)**

Unit II: Laplace Transform
Laplace Transforms: Laplace transforms and their simple properties, Unit step function, inverse of Laplace transform, convolution theorem, Applications of Laplace transform to solve ordinary differential equations . **(7 hours)**

Unit III: Z-transform
Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and residue theorem, Applications of Z-transform to solve difference equations with constant co-efficient. **(6 hours)**

Unit IV: Fourier Series
Periodic Functions and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions **(7 hours)**

Unit V: Partial Differential Equation
Partial Differential Equations of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve first and second order partial differential equations. **(7 hours)**

Unit VI : Fourier Transform : Definition: Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem**.** **(6 hours)**

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John Wiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John Wiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune Vidyarthi Griha Prakashan
5	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	Laxmi Prakashan

III Semester
EE2201 - Electronic Devices

Course Objective	Course Outcomes
1. The purpose of this course is to present a clear consistent picture of the internal physical behaviour of many electronic devices so that their studies of electronic circuit and system will be meaningful. 2. The purpose of this course is to introduce to the students, the basics of biasing of transistor circuits, feedback amplifiers & analyzing different two port devices.	Students will be able 1. To understand the concepts of Energy Bands, Charge Carriers and various semiconductor devices like diodes and BJT 2. Be familiarized with semiconductor device fabrication processes. 3. To understand various configurations and their characteristics for BJT and MOSFET amplifiers 4. To understand the concepts of Stabilization and operating points of BJT and MOSFET amplifiers

Unit I: Energy Bands and Charge carriers in Semiconductors
Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equations.

Unit II: Diode and its applications
PN junction diode, diode equation, The Volt-Ampere Characteristics, The Temperature Dependence of the Characteristics, Diode Resistance, Diode Circuits: DC Analysis and Models, AC Equivalent Circuit, Zener breakdown, avalanche breakdown, Clipping, Clamping, Rectifier circuits, Basic Design of DC Power Supply ,Tunnel Diode, Schottky Barrier Diodes, Varactor Diodes, LED, photo diode and solar cell.

Unit III: Device Fabrication Process
Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process.

Unit IV: Bipolar Junction Transistor and its Configurations
Bipolar Junction Transistor Construction, Operation, The Common-Base Configuration and its Characteristics, The Common-Emitter Configuration and its Characteristics, Common-Collector Configuration and its Characteristics, Transistor as an Amplifier and Switch.

Unit V: MOSFET and its Configurations
MOS Field-Effect Transistor, Two-Terminal MOS Structure, n-Channel Enhancement-Mode MOSFET, Ideal MOSFET Current–Voltage Characteristics—NMOS Device, p-Channel Enhancement-Mode MOSFET, Ideal MOSFET Current–Voltage Characteristics—PMOS Device.

Unit VI: BJT and MOSFET Amplifier Configurations
Common Emitter, Common Base, Common Collector Common-Source Circuit, Common-Drain Circuit, Common-Gate Circuit, Biasing.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Electronic Devices and Circuits Theory	BoyleSted, Nashelsky,	10th Edition.	Pearson
2	Microelectronics Circuit Analysis and Design	Donald Neaman	4th Edition	McGraw Hills, 2010
3	Op-amps and linear integrated circuits,	R. A. Gayakwad	3rd edition	PHI, 1995

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Integrated Electronics,	MillManHalkias	3rd reprint, 2007.	Tata McGraw Hil
2	Microelectronics Circuits	Sedra Smith	6th Edition	Oxford Uni. Press

III Semester
EE2202 - Lab. : Electronic Devices

Course Objective	Course Outcomes
↙ The purpose of this course is to present a clear consistent picture of the internal physical behavior of many electronic devices so that their studies of electronic circuit and system will be meaningful. ↙ The purpose of this course is to introduce to the students, the basics of biasing of transistor circuits, feedback amplifiers & analyzing different two port devices.	Students will be able 1. To understand the concepts of Energy Bands, Charge Carriers and various semiconductor devices like diodes and BJT 2. Be familiarized with semiconductor device fabrication processes. 3. To understand various configurations and their characteristics for BJT and MOSFET amplifiers 4. To understand the concepts of Stabilization and operating points of BJT and MOSFET amplifiers

Expt. No.	Name of Experiment
1	To plot the V- I characteristics of PN junction diode (Silicon and Germanium) and perform simulation in LT-Spice.
2	To plot the V- I characteristics of Zener shunt regulator.
3	To determine the Ripple factor and efficiency of Half wave and full wave rectifier with and without capacitive filter and perform simulation in LT-Spice.
4	To plot I/P & O/P Characteristics of Common Base Transistor Configuration. Find I/P & O/P Resistance and Current Gain.
5	To plot I/P & O/P Characteristics of Common Emitter Transistor Configuration. Find I/P & O/P Resistance and Current Gain.
6	Analysis of Fixed Bias circuit of transistor.
7	Analysis of Self Bias circuit of transistor
8	To plot the Drain and Transfer characteristics of Field Effect Transistor (FET) in CS mode.
9	To plot the Drain and Transfer characteristics of Metal Oxide Semiconductor Field Effect Transistor (MOSFET) in CS mode.
10	Mini Project

III Semester
EE2203 - Signals & Systems

Course Objective	Course Outcomes
↙ The objective of this course is to have an introduction to approaches of signals & systems analysis with an increased emphasis on the frequency response and Analysis of system with continuous signal. ↙ To enable the students, their time and Frequency characteristics.	Students will be able to 1. Classify continuous time signals and systems, transformation of independent variable. 2. Analyze Fourier series, Fourier transform representation of continuous-time periodic and aperiodic signals. 3. Determine and evaluate Laplace Transform of continuous time signals. 4. Analyze time & frequency characterization of Signals and Systems & Sampling Theorem

Unit I: Continuous and Discrete time signals **[6 hr]**
Signal representation, Transformation of the independent variable, classification of signals, Signal Energy and Power, Periodic, Even & Odd, Real and Exponential Signals

Unit II: Continuous and Discrete time System [6 hr]
Continuous-Time Systems, system properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, convolution

Unit III: Fourier Series Representation of Periodic Signals [6 hr]
Fourier Series Representation of Continuous-Time Periodic Signals, convergence of the Fourier Series.

Unit IV: Fourier Transform [6 hr]
Convergence of Fourier Transform and its Properties, Representation of Aperiodic Signals, The Fourier Transform for Periodic Signals. Analysis and Characterization of LTI Systems using the Fourier Transform.

Unit V: The Laplace Transform [6 hr]
The Laplace Transform. The Region of Convergence for Laplace Transforms. The Inverse Laplace Transform. Properties of the Laplace Transform. Analysis and Characterization of LTI Systems Using the Laplace Transform. The Unilateral Laplace Transform

Unit VI: Z transform [6 hr]
The Z Transform. The Region of Convergence for Z Transforms. The Inverse Z Transform. Properties of the Z Transform. Analysis and Characterization of LTI Systems Using the Z Transform

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Signals and Systems	Alan V. Oppenheim, Alan S. Willsky, with S. Hamid	2nd Edition, 1996	Prentice Hall
2	Digital signal processing –Principles, algorithms and applications	J. G. Proakis, D. G. Manolakis	3rd Edition, 1996	PHI

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Outline of Signals and Systems	Hwei Hsu,Schaum's	1st Ed 1995	McGraw-Hill
2	Signals & Systems	Simon Haykin and Van Veen	2nd Edition, 2002	Wiley
3	Signals & Systems Analysis Using Transformation Methods & MAT Lab	Robert	2003	TMH
4	Signals, Systems and Transforms	C. L. Philips, J.M.Parr and Eve A.Riskin	3rd Edition, 2004.	
5	Signals & Systems	I.J.Nagrath, S.N.Sharan, R.Ranjan, S.Kumar	2001	Pearson education

III Semester
EE2204 - Lab : Programming Language

Course Objective	Course Outcomes
1. To understand Python is a useful scripting language for developers. 2. To learn how to design and program Python applications.	1. To understand syntax and semantics of language 2. To understand and apply the basics of the programming language 3. To understand and apply special language features 4. To develop any application

Expt. No.	Name of Experiment
1	Write, test, and debug simple Python programs
2	Implement Python programs with conditionals and loops
3	Develop Python programs step-wise by defining functions and calling them.
4	Develop Python programs step-wise by Python lists
5	Develop Python programs step-wise by Python tuples
6	Develop Python programs step-wise by Python dictionaries for representing compound data.
7	Read and write data from/to files in Python.
8	Application Development

III Semester
EE2205 - Digital Logic Design

Course Objective	Course Outcomes
⇗ Develop a strong foundation of digital electronics. ⇗ Understand concepts of combinational and sequential circuits. ⇗ Develop and design synchronous circuits and sequential machines.	Students will be able to: 1. Simplify combination logic circuits using Boolean algebra and exhibit the methods to solve logical functions using K-map and Quine-Mc-Clauskey methods. 2. Understand and apply the concept of combinational logic circuits in various digital systems. 3. Understand and demonstrate the various codes and illustrate concept of logic family with their characteristics. 4. Understand the working of Flip-flops and its use to design Synchronous counters and Design and demonstrate finite state machines.

Unit I: **(7 Hr)**
Number Systems and IEEE Floating point representations, Logic gates, Switching Algebra & simplification of Boolean expressions, Boolean algebraic theorems, DeMorgan's theorem, SOP, POS, Canonical forms of Boolean expression. Implementations of Boolean expressions using logic gates.

Unit II: **(6 Hr)**
Combinational Circuits: Minimization methods: Incompletely specified functions, Karnaugh map, Quine McClauskey methods.

Unit III: **(7 Hr)**
Design of Arithmetic circuits: Half & Full adders, Half & Full Subtractions, Multi-bit parallel adders Carry Propagate adder & Carry Look ahead adder, Comparators, Multi-bit Application designs, Formation of switching functions from word statements, Functions & its implementation using Multiplexer, Demultiplexer, Encoder, Decoder,

Unit IV: **(6 hr)**
Combinational circuits design using MSI and LSI chips, PLA's ,Parity Checkers and generators, Introduction to Logic families & their characteristics such as Fan-In, Fan-out, Propagation delay, Power dissipation, Noise Margin.

Unit V: **(7 Hr)**
Sequential circuits: Latches and flip-flops: RS-FF, D-FF, JK-FF, Master-Slave JK-FF & T-FF's, Excitation & Truth Table, Flip-flop conversions, Shift registers. Introduction to Synchronous, Counters: Ring counter, Johnson counter, Ripple counter, Design of synchronous counter.

Unit VI: **(7 Hr)**
Classification of synchronous machines, Design of synchronous sequential machines using Moore & Mealy circuits: Sequence detector, State diagram, State reduction (Method of Partitioning) and implementation.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Digital Circuits & Microprocessors	Hebert Taub	1988.	Mc Graw Hill
2	Switching Theory & Finite Automata	Zvi Kohavi	2nd edition 2004	Mc Graw Hill

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Fundamentals of Logic Design	C.H.Roth	7th edition 2014.	Public Work & Services
2	Modern Digital Electronics	RP Jain	3rd Edition	Tata McGraw Hill
3	Digital Design	M. Morris Mano	4th edition 2008	Prentice Hall of India

III Semester
EE2206 - Lab. : Digital Logic Design

Course Objective	Course Outcomes
↗ Develop a strong foundation of digital electronics. ↗ Understand concepts of combinational and sequential circuits. ↗ Develop and design synchronous circuits and sequential machines.	Students will be able to: 1. Simplify combination logic circuits using Boolean algebra and exhibit the methods to solve logical functions using K-map and Quine-Mc-Clauskey methods. 2. Understand and apply the concept of combinational logic circuits in various digital systems. 3. Understand and demonstrate the various codes and illustrate concept of logic family with their characteristics. 4. Understand the working of Flip-flops and its use to design Synchronous counters and Design and demonstrate finite state machines.

Expt. No.	Name of Experiment
1	Introduction to SPICE Digital model and commands.
2	Finding out Vohmin, Volmax, Vihmin, Vilmax,Delay Td, Power Supply Range (using SPICE)
3	Finding out Vohmin, Volmax, Vihmin, Vilmax, Delay Td, Power Supply Range (using Hardware)
4	Verify basic Logic gates, MUX, DeMUX, Truth Tables(using SPICE and using Hardware)
5	To Implement Coder decoder (using SPICE and using Hardware)
6	To Implement & verify adder circuits.
7	To Implement & Verify parity checkers circuit (using SPICE and using Hardware)
8	To verify the truth table of all flip-flops. (using SPICE and using Hardware)
9	To Design binary synchronous/asynchronous counter. (using SPICE and using Hardware)
10	To Design Finite State Machine (using SPICE and using Hardware)

III Semester
EE2207- Network Analysis

Course Objective	Course Outcomes
The basic objective of this course is to introduce students to the fundamental theory and mathematics for the analysis of electrical circuits. Through the material presented in this course, students will learn: ↙ To understand basic of circuits elements and energy sources ↙ To know the fundamental theory and Mathematics for the analysis of electrical circuits.	On successful completion of this course, students should be able to: 1. Apply and analyze nodal and mesh analysis on circuits 1. Apply network theorems initial and final conditions to analyze circuits 2. Understand, apply and analyze circuits in transform domain 3. Apply the concept of two – port networks to find different two-port parameters.

UNIT-1: **Nodal Analysis of Electric Circuits**
Basics of electric circuits, circuit elements and their voltage – current relationship, classification of circuit elements, sources - their types and characteristics, concept of equivalent sources, source transformation and duality, concept of supernode and V – shift, nodal analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-2: **Mesh Analysis of Electric Circuits**
Concept of super mesh and I – shift, mutual inductance, coefficient of coupling, dot convention, dot marking in coupled coils, mesh analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-3: Network Theorem
Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem

UNIT-4: Initial and Final Conditions, Impedance Functions and Circuit Analysis with Laplace Transform
Concept of initial and final conditions, behaviour of resistor, inductor and capacitor at t = 0- and at t = 0+, procedure for evaluating initial and final conditions, analytical treatment. Review of Laplace Transform, concept of complex frequency, transform impedance and admittance, s – domain impedance and admittance models for resistor, inductor and capacitor, series and parallel combinations of elements. Transformed network on loop and mesh basis, mesh and node equations for transformed networks, time response of electrical network with and without initial conditions by Laplace transform.

UNIT-5 : Transforms of other Signal Waveforms, Network Functions, Poles and Zeros of network functions
Unit step, ramp and impulse functions with and without time delay, their Laplace transform, waveform synthesis and its application to electrical networks. Terminal pairs or ports, network functions for one port and two port networks, definition and physical interpretation of poles and zeros, pole-zero plot for network functions, restrictions on pole and zero locations for driving point and transfer functions, time domain behaviour from the pole – zero plot, network synthesis using pole – zero plot.

UNIT-6: Two Port Parameters
Standard reference directions for the voltages and currents of a two – port network, defining equations for open circuit impedance, transmission, inverse transmission, hybrid and inverse hybrid parameters, relationships between parameter sets, conditions for reciprocity and electrical symmetry in terms of two – port parameters, interconnections of two - port networks.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Network Analysis	M. E. Van Valkenburg	3rd Edition	PHI Learning Private Limited.
2	Circuits and Network	Sudhakar, A., Shyammohan, S. P.;		Tata McGraw-Hill New Delhi
3	Engineering Circuit Analysis	A William Hayt	8th Edition	McGraw-Hill Education.

III Semester
EE2208- Lab. : Network Analysis

Course Objective	Course Outcomes
The basic objective of this course is to introduce students to the fundamental theory and mathematics for the analysis of electrical circuits. Through the material presented in this course, students will learn: ↙ To understand basic of circuits elements and energy sources ↙ To know the fundamental theory and Mathematics for the analysis of electrical circuits.	On successful completion of this course, students should be able to: 1. Apply and analyze nodal and mesh analysis on circuits 2. Apply network theorems, initial and final conditions to analyze circuits 3. Understand, apply and analyze circuits in transform domain 4. Apply the concept of two – port networks to find different two-port parameters.

Expt. No.	Name of Experiment
1	Introduction To PSPICE Software.
2	SPICE Models for various components. Verification of Kirchhoff's law.
3	SPICE Models for various sources. Perform nodal analysis on complex electrical circuits
4	Perform mesh analysis on complex electrical circuits.
5	Verification of Superposition Theorem.
6	SPICE Analysis Methods. Verification of Thevenin's Theorem.
7	SPICE Analysis Methods. Verification of Norton's theorem.
8	SPICE Analysis Methods .Verification of Maximum power transfer theorem.
9	SPICE Analysis Methods .Determinations of Transfer function of Two port network.
10	Determination of Z & Y parameters of Two Port Network.

Nagar Yuwak Shikshan Sanstha's

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Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

4th Semester

Electronics Engineering

IV Semester
GE2204 - Advanced Mathematical Techniques

Objective	Outcomes Students will be able to
• To introduce various Numerical Methods to solve algebraic and differential equations • To understand the concept of Probability distribution • To introduce the concept of Fuzzy Set theory and functions • To make aware of different optimization techniques	• Utilize numerical techniques to obtain approximate solutions of mathematical equations • Measure the Statistical parameters for random variables • Explain the basic concept of fuzzy sets, Relations and fuzzy logic. • Design and determine the solution of linear programming problems

Unit I:
Numerical Methods for Algebraic And Transcendental Equations: Errors in numerical calculation, Errors in series approximation, Rounding of error solutions of algebraic and transcendental equations, Iteration method, Bisection method, False position method, Newton Raphson method and their convergence **Numerical Methods System of Algebraic Equations**: Solution of System of linear equations, Gauss- Seidel method, Crouts method**.**
(7 hours)

Unit II:
Numerical Methods for Differential Equations: Numerical solution of ordinary differential equation by Taylor's series method, Picard's method, Runge's second and third order method, Runge-Kutta 4^{th} order method, Euler's method, Euler's modified method, Milne's Predictor and Corrector method. **(6 hours)**

Unit III:
Random Variables and Probability Distribution: Discrete and continuous random variables, probability density function of one and two variables, Probability distribution function of one and two variables, Joint distributions and conditional distributions. **(6 hours)**

UNIT IV:
Mathematical Expectation: Definition of mathematical expectation, functions of one and two random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis. **(7 hours)**

UNIT V:
Fuzzy Sets And Fuzzy Logic: Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.
(7 hours)

Unit VI:
OPTIMIZATION TECHNIQUES: Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method. **(6 hours)**

Text Books:

SN	Title	Edition	Authors	Publisher
1	Computer based Numerical and Statistical Techniques	Paperback Firstedition 2003	M. Goyal	Laxmi Publication
2	Numerical Methods	Fourth Edition (2004)	S.S. Sastri	PHI Publishers
3	Fuzzy Engineering	Softcover edition (2005)	Bari Kosko	Prentice Hall PTR
4	Optimization Techniques	Year-2009.First Edition	C.Mohan and Kasum Deep	New Age International Publication

IV Semester
GE2204 - Advanced Mathematical Techniques

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Advanced Engineering Mathematics	4th edition 2006	H.K.Dass	S. Chand Group
2	Advanced Engineering Mathematics	9th Edition-2007	Kreyszig	JOHN WILEY & SONS
3	Mathematics for Engineers	19th edition 2007	Chandrika Prasad.	JOHN WILEY & SONS
4	Advanced Mathematics for Engineers	4th edition 2006	Chandrika Prasad	JOHN WILEY & SONS
5	Higher Engineering Mathematics	40 edition 2010	B S Grewal	Khanna Publishers
6	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	LaxmiPrakashan

IV Semester
EE2251 - Electronic Circuits

Objective	Outcomes
The purpose of this course is to present a clear consistent picture of the high frequency behavior of BJT and MOSFET based amplifiers and classification based on different modes of working so that their studies of electronic circuit and system will be meaningful.	1. Students will be able to know the low frequency parameters and analysis of BJT, MOSFET and its configuration. 2. Students will be able to know the high frequency parameters and analysis of BJT, MOSFET and its configuration. 3. Students will be able to analyze amplifiers with and without feedback. 4. Students will be able to analyze Power amplifier and Oscillators.

Unit I: BJT Amplifiers (Low frequency: (Single and Multi-stage)
The Bipolar Linear Amplifier, Graphical Analysis and ac Equivalent Circuit, Small-Signal Hybrid-π Equivalent Circuit of the Bipolar Transistor, Small-Signal Voltage Gain, Hybrid-π Equivalent Circuit, Including the Early Effect, Other Small-Signal Parameters and Equivalent Circuits, Basic Transistor Amplifier Configurations, Common-Emitter Amplifiers, Ac Load Line Analysis, Common-Collector (Emitter-Follower) Amplifier, Common-Base Amplifier, Multistage Amplifiers.

Unit II: MOSFET Amplifiers (Low frequency: Single-Stage)
The MOSFET Amplifier, Graphical Analysis, Load Lines And Small-Signal Parameters, Small-Signal Equivalent Circuit, The Common-Source Amplifier, The Common-Drain (Source-Follower) Amplifier, The Common-Gate Configuration, Multistage Amplifiers

UNIT III: Transistor Amplifiers at High-frequency
Amplifier Frequency Response, System Transfer Functions, Transistor Amplifiers With Circuit Capacitors, Frequency Response: Bipolar Transistor, Expanded Hybrid- π Equivalent Circuit, Short-Circuit Current Gain, Cut-off Frequency, Miller Effect.

UNIT III: MOSFET Amplifiers at High-frequency
The MOSFET Amplifiers: Common Source Amplifier, Common Drain Amplifier, High-Frequency Equivalent Circuit, High-Frequency Response of MOSFET Circuits, Multistage MOSFET Amplifiers.

UNIT V: Feedback Configurations
Basic Feedback Concepts, Feedback Topologies, Analysis of Voltage-Series, Voltage-Shunt, Current- series and Current Shunt feedback amplifiers, Oscillators: Barkhausen's criterion, RC phase shift oscillators, Wien bridge, Tuned Oscillators: Hartley, colpitts, crystal Oscillators

UNIT VI: Power Amplifiers
Power Amplifiers, Power Transistors, Power MOSFETS, Heat Sinks, Classes Of Amplifiers, Class-A Operation, Class-B Operation, Class-AB Operation, Class-C Operation, Class-A Power Amplifiers, Inductively Coupled Amplifier, Transformer-Coupled Amplifiers, Class-AB Output Stage.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Electronic Devices and Circuits Theory	BoyleSted, Nashelsky,	10th Edition.	Pearson
2	Microelectronics Circuit Analysis and Desig	Donald Neaman	4th Edition	McGraw Hills, 2010
3	Op-amps and linear integrated circuits,	R. A. Gayakwad	3rd edition	PHI, 1995

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Integrated Electronics,	MillManHalkias	3rd reprint, 2007.	Tata McGraw Hil
2	Microelectronics Circuits	Sedra Smith	6th Edition	Oxford Uni. Press

IV Semester
EE2252 - Lab. : Electronic Circuits

Objective	Outcomes
The purpose of this course is to present a clear consistent picture of the high frequency behavior of BJT and MOSFET based amplifiers and classification based on different modes of working so that their studies of electronic circuit and system will be meaningful.	1. Students will be able to know the low frequency parameters and analysis of BJT, MOSFET and its configuration. 2. Students will be able to know the high frequency parameters and analysis of BJT, MOSFET and its configuration. 3. Students will be able to analyze amplifiers with and without feedback. 4. Students will be able to analyze Power amplifier and Oscillators.

Exp No	Name of Experiment
1.	Evaluation of small signal h and π-parameter using BJT.
2.	To Plot the Frequency Response of single stage RC coupled CE amplifier with feedback
3.	To Plot the Frequency Response of single stage RC coupled CE amplifier without feedback
4.	To simulate the Frequency Response of single stage RC coupled CE amplifier on LT-spice.
5.	To Plot the Two stages RC coupled amplifier with voltage series feedback.
6.	To simulate the Frequency Response of Two stage RC coupled CE amplifier on LT-spice.
7.	To simulate the Frequency Response of Common Source MOSFET Amplifier on LT-spice.
8.	To determine the efficiency of Class B push pull power amplifier and to study cross over distortion.
9.	To determine the phase shift in RC phase shift oscillator.
10.	Mini project

IV Semester
EE2253 - Microcontroller & its Applications

Objective	Outcomes
↙ To provide the acquaintance with concepts of inbuilt memory, I/O Ports ,timer, serial communication using 8051 ↙ To develop the 8051 based projects	A student who completes this course will be able to: 1. Understand & Learn concept of Architecture of 8051 µc 2. Apply the concept of programming language to interface I/O Devices 3. Establish the serial communication between the I/O Devices. 4. Design Data Acquisition System related to Industries

Unit I: (8 Hrs)
Overview of 8051 Microcontroller family, Introduction to MCS 51 family, Architecture, Memory organization, Internal RAM, Flag Register, Register Banks, SFRs , Functional pin description and various resources of MCS 51, Hardware Overview, Addressing modes, Instruction set and Assembly language programming Programs using look up table.

Unit II: (7 Hrs)
Loop, Jump and Call instructions, Bit manipulation, 8051 I/O programming, Delay Programs. I/O Interfacing such as LED, switches, 7segment display, keyboard matrix programming.

Unit III: (8 Hrs)
8051 programming in C: Data types and time delay, I/O programming, Logic operations, Data conversion programs, Lookup table access, Timer programming in assembly and C: Various modes of operation, SFR related to timer operation.

Unit IV: (7 Hrs)
Serial Port programming in assembly and C: Basics of serial communication, 8051 connection to RS 232. Serial data transfer programs. 8051 interrupts, Interrupts programming in assembly and C, programming timer interrupt, external interrupt, serial interrupt.

Unit V: (7 Hrs)
Interfacing and programming for LCD, Interfacing RTC, EEPROM using I2C Bus and programming.

Unit VI: (8 Hrs)
Interfacing of ADC, DAC, stepper motor and PS2 keyboard and programming

Text Books:
1) The 8051 Microcontroller and Embedded systems , Muhammad Ali Mazidi , J.G. Mazidi, 2nd edition Pearson Education, Prentice Hall of India.
2) 8051 Microcontrollers programming and practice By Mike Predcko.
3) The 8051 Microcontroller Architecture, programming and Applications By Kenneth Ayala, Penram India publication.
4) Advanced Microprocessors and Peripherals , A. K. Ray, K. M. Bhurchandi, Second edition, Tata McGraw Hill, 2000.

Reference Book:
1) Intel or Atmel MCS 51 Family Microcontrollers Data Sheets.

IV Semester
EE2254 - Lab. : Microcontroller & its Applications

Objective	Outcomes
↗ To provide the acquaintance with concepts of inbuilt memory, I/O Ports ,timer, serial communication using 8051 ↗ To develop the 8051 based projects	A student who completes this course will be able to: 1. Understand & Learn concept of Architecture of 8051 µc 2. Apply the concept of programming language to interface I/O Devices 3. Establish the serial communication between the I/O Devices. 4. Design Data Acquisition System related to Industries

Exp No	Name of Experiment
1	Add data bytes in an internal RAM.
2	Convert single digit Hex number to its ASCII equivalent
3	Find the maximum data byte in a block
4	Data block transfer.
5	Find three numbers of negative data bytes in a block.
6	Convert BCD to its binary equivalent.
7	Generate a saw tooth waveform using DAC.
8	Read Analog signal from channel 2 of ADC and store it to internal RAM.
9	Rotate stepper motor into clockwise and counter clockwise direction
10	Generate square waveform from pin no P 1.2 of 8051
11	Display character on LCD.

IV Semester
EE2255 - Analog Communication

Objective	Outcome
To Study different modulation techniques. To understand transmitter &receivers communication systems. To learn the concept of PPM, PAM, PWM & PCM. To learn basics of noise, types of noise & various propagation layers, spectrum of electromagnetic waves.	Students will be able to 1. Demonstrate and analyze various amplitude, angle modulation techniques. 2. Understand various types of receivers & noise in communication system and investigate noise parameters. 3. Understand pulse modulation & multiplexing techniques. 4. Apply the concept of Radiation & Propagation of waves to design communication system

UNIT-1: **(7 Hrs)**

Amplitude Modulation: Need for modulation, mathematical Analysis, modulation index, frequency spectrum, power requirement of AM, DSB-SC, Balanced Modulator for carrier suppression, SSB, Methods of SSB Generation, ISB, VSB transmissions, Generation of AM system.

UNIT-2: **(8 Hrs)**

Angle Modulation: Frequency Modulation (FM), mathematical Analysis, modulation index, frequency spectrum, power requirement of FM, narrowband & wideband FM, noise triangle in FM, pre-emphasis & de-emphasis techniques, phase modulation, noise reduction characteristics of angle modulation, FM Transmitter.

UNIT-3: **(8 Hrs)**

Receivers: Basic receiver (TRF), Super heterodyne receiver, performance parameters for receiver such as sensitivity, selectivity, fidelity, image frequency rejection etc., AM detectors, FM discriminators, AGC technique, double-spotting effect.

UNIT-4: **(8 Hrs)**

Noise: External Noise, internal Noise, Noise Calculations, Addition of Noise due to several sources, Addition of Noise due to several amplifiers in cascade, Noise in reactive circuits, Definition of Noise figure, signal to noise ratio, calculation of noise figure, Noise figure from equivalent resistance, Noise Temperature.

UNIT-5: **(8 Hrs)**

Pulse Modulation: Generation and demodulation of PAM, PWM, PPM, Time division Multiplexing, Frequency division multiplexing, Pulse code modulation.

UNIT-6: **(8 Hrs)**

Radiation & Propagation of waves:-Fundamental of electromagnetic waves, propagation of waves- Ground wave, space wave and sky wave propagation, tropospheric scatter propagation, extraterrestrial communications.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Electronic Communication System	Gorge Kennedy	4th Edition, 1999	Tata McGraw-Hill
2	Digital and analog communication systems	K. Sam Shanmugam	5th Edition, 2003	John Wiley & Sons

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Electronic Communication Systems	Frank R. Dungan	Second Edition, 1993	Delmar Publishers
2	Communication Electronics	Louis Frenzel	Third Edition, 2007	McGraw-Hill

IV Semester
EE2256 - Lab. : Analog Communication

Objective	Outcome
↙ To Study different modulation techniques. ↙ To understand transmitter &receivers communication systems. ↙ To learn the concept of PPM, PAM, PWM & PCM. ↙ To learn basics of noise, types of noise & various propagation layers, spectrum of electromagnetic waves.	Students will be able to 1. Demonstrate and analyze various amplitude, angle modulation techniques. 2. Understand various types of receivers & noise in communication system and investigate noise parameters. 3. Understand pulse modulation & multiplexing techniques. 4. Apply the concept of Radiation & Propagation of waves to design communication system

Exp No	Name of Experiment
1	To study the Generation of Amplitude Modulation using transistor. Calculate modulation index for value of modulating amplitude.
2	To study the Generation of Amplitude Demodulation using Envelop Detector.
3	To study the Generation of Frequency Modulation using IC 8038 function generator.
4	To perform Frequency Demodulation using Foster Seeley Detector.
5	To perform DSB-SC using Ring Modulator.
6	Generation of Pulse Amplitude Modulation using IC 555 & IC 4016.
7	Generation of PWM signal using IC 555.
8	Generation of PPM signal using IC 555.
9	To perform Time Division Multiplexing (TDM).
10	To perform Amplitude Modulation using Simulink tool in MATLAB
11	To perform Frequency Modulation using Simulink tool in MATLAB

IV Semester
EE2257 - Electromagnetic Fields

Objective	Outcome
↗ To introduce students with different coordinate systems. ↗ To familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems. ↗ To understand the basic laws applicable to electric and magnetic field. ↗ To expose the students to the ideas of electromagnetic waves.	After study through lectures and assignments, students will able to: 1. Define and recognize different co-ordinate systems, apply different techniques of vector calculus to understand concepts of electromagnetic field theory. 2. Determine the electromagnetic force exerted on charged particles, current elements, working principle of various electric and magnetic fields. 3. Explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields in different media using the fundamental laws. 4. Deduce and justify the concepts of electromagnetic waves, means of transporting energy or information, in the form of radio waves.

Unit I: **(7 Hours)**
Orthogonal coordinate systems: Cartesian, Cylindrical, Spherical and Transformations, differential lengths, surfaces and volumes.

Unit II: **(7 Hours)**
Coulomb's law, Electric field Intensity for different charge distribution: Point, Line, Surface & Volume, Electric flux, Gauss's law and Application, Divergence, Maxwell's First equation (Electrostatics), The Divergence Theorem.

Unit III: **(7 Hours)**
Energy & Potential: Energy Expended in Moving a Point charge in an Electric Field, Definition of Potential Difference and Potential, Potential field of a point charge, Potential field of a System of charges: Conservative Property, Potential Gradient, The Dipole, Poisson's and Laplace's equation, Uniqueness Of Electrostatic solution.

Unit IV: **(8 Hours)**
Biot-Savart's law and its applications, Ampere's Circuital law and its applications, Curl, Stoke's Theorem, Magnetic flux and magnetic flux density, Faraday's law, displacement current, Maxwell's equations for static and time varying fields with physical significance.

Unit IV: **(7 Hours)**
Uniform plane wave, wave propagation in free space & dielectric, Poynting's Theorem and Wave Power, Propagation in Good Conductors: Skin Effect.

Unit VI: **(7 Hours)**
Reflection of uniform plane waves at Normal incidence, standing wave ratio, plane wave propagation in general directions, plane wave reflection at oblique incidence angles, Brewsters angle.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Engineering Electromagnetic	William H. Hayt,	7th Edition	Tata McGraw – Hill, 2006 reprint.
2	Electromagnetics	J D Kraus	3rd edition 1984	McGraw – Hill

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Electromagnetism: Theory and application	Ashutosh Pramanik	2nd edition august 2009	Prentice Hall
2	Elements of Electromagnetics	M. N. O. Sadiku	4th edition 2007	Oxford Press
3	Field and Wave Electromagnetics	David K. Cheng	Second Edition	Addison Wesley

IV Semester
EE2258 - Lab: Simulation Lab/Workshp Lab

Objective	Outcome
↙ To Acquaint Students with basic Electronics Workshop practices like, identification of components, operate and control various machines, repair, troubleshooting, and Circuit Design Methods. ↙ To create interest in Hardware Technology. ↙ Student will understand Project Implementation and testing with proper report writing.	Students Will able to 1. Identify different Electronics Components. 2. Do mini project to enhance their practical Knowledge. 3. Artwork, printing, Etching & drilling of PCB 4. Work in a teamwork

Exp No	Name of Experiment
1	Study of Passive Elements : Resistors, Capacitors, Inductors etc.
2	Study of Active Elements : Diodes, Transistors, Thyristors, Power Supplies etc.
3	Study of Electronic Transformers.
4	Study of Wires, Cables etc.
5	Study of Interconnect Components: Electromechanical Switches, Solid state relays, Optocouplers etc.
6	Study of Speakers and Microphones.
7	Study of Electronic Circuit Protection Components: Fuses, Circuit Breakers, Zener Diodes etc.
8	Electronics Mini Project : Selection, Estimation, PCB layout design, Fabrication, Soldering, Testing, Troubleshooting , Results , Report etc.
9	Interconnect components: Solid state Relays, Coaxial RF connectors, Mechanical switches for electronic Circuits.
10	Electronic Circuit Protection: Snubber Capacitor (IGBT Protection), Thermisters, Discrete Semiconductor, Over voltage Protection, Over Current Protection.
11	Study of LTCC (Low Temperature co -fired Ceramic Tapes, Niobium Oxide Capacitors, EDLC (Electronic Double Layer Carbon) Super Capacitors.
12	Study of Chip Resistors, Line feed Resistors (Surge Resistors Networks).

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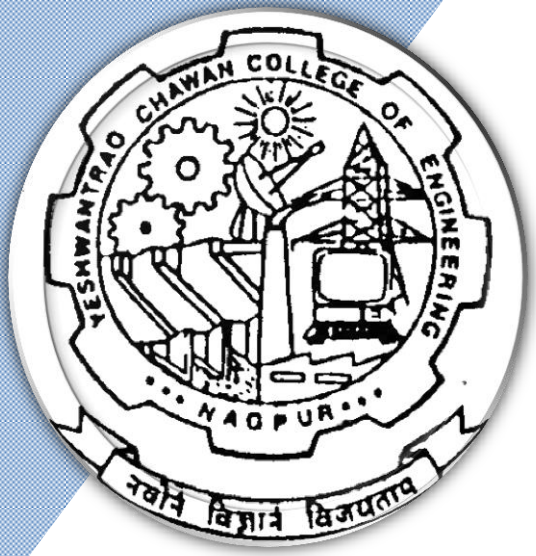

Bachelor of Technology
SoE & Syllabus 2020
5th Semester
Electronics Engineering

V Semester
GE2311 - Fundamentals of Management

Objective	Outcomes Students will be able to
To introduce the fundamentals and legal provision of Management	Explain the Legal provision and Functions of Management.
To introduce the Human Resource and Financial practice of organization	Analyze the role of Human Resource and Financial Management in the organization.
To Introduce the Project Management	Analyze the project life cycles.
To provide knowledge of Marketing Activities of Management	Identify tools and techniques for the marketing of goods and services.

Unit – 1 - Principle of Management

Evolution of Management Thought : Scientific and Administrative Theory of Management , Definition and Concept of Management, Functions of Management : Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership

UNIT-2: Legal Aspects of Management

The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up of the Company

UNIT-3: Human Resource Management

Human Resource Management-Meaning and Scope, Principles of HRD, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Grievance Redressal Procedure .

UNIT-4: Project Management

Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Tools and Techniques of Project Management, Network techniques - Introduction and Use of CPM &PERT for planning, SWOT Analysis, Project Risk Analysis, Project Control.

UNIT-5: Marketing Management

Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

V Semester
GE2311 - Fundamentals of Management

UNIT-6: Financial Management

Definition & Functions of Finance department, Sources of finance, Types of capital, Profit maximization vs. Wealth Maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

Text book and Reference

1. Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2. Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3. Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4. C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,
5. Lock, Gower - Project Management Handbook
6. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11. Khan M Y - Financial Services (Tata Mc Graw Hill, 19

V Semester

EE2301 – Digital Signal Processing

Objective	Course Outcome
1. This course will provide solid foundations of discrete time signal processing fundamental concepts, Transform domain analysis, Mathematical analysis of FIR and IIR filter design.	**On completion of this course, the student will be able to** 1. Apply DFT and Z transform for the analysis of signals and systems 2. Construct and optimize structures for the realization of discrete Time system 3. Design of Analog and Digital Filters for given specifications 4. Understand fundamentals and architecture of DSP processor. 5. Simulation and verification of various transform techniques and filter Design

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Apply DFT and Z transform for the analysis of signals and systems	3	2	1	2	2									
CO 2	Construct and optimize structures for the realization of discrete Time system	3	3	1	2	2									
CO 3	Design of Analog and Digital Filters for given specifications	3	3	3	2	2									
CO 4	Understand fundamentals and architecture of DSP processor	2	2	1	1	1									
CO 5	Simulation and verification of various transform techniques and filter Design	2	2	2	2	2								2	2

V Semester

EE2301 – Digital Signal Processing

Unit No.	Contents	Max. Hrs.
1	Discrete Time(DT) Signals and System, Classification of DT signals, classification of DT systems, linear Convolution, Sampling and reconstruction.	7
2	Discrete Time Fourier Transform, Discrete Fourier Transform, Computation of DFT, Properties of DFT, convolution of data sequences, FFT algorithms, Decimation in time, Decimation in Frequency	7
3	Digital Filter structures: FIR digital filter structures, IIR digital filter structures, Lattice structures, Finite word length effect.	7
4	IIR Digital filter Design, Bilinear transformation, Impulse invariant transformation, Low pass IIR digital filters, Butterworth and Chebyshev filter.	7
5	FIR Digital Filter Design, FIR filter design using windowing techniques	7
6	Multirate Digital Signal processing fundamentals, sampling rate alteration, multirate structures, Decimator and Interpolator and Multistage design.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Discrete time signal processing	2nd edition, 1999	V. Oppenheim, R, W, Schafer	PHI
2	Digital signal processing – Principles, algorithms and applications	3rd Edition ,1996	J. G. Proakis, D. G. Manolakis	PHI

V Semester

EE2302 – Lab: Digital Signal Processing

Expt. No.	Name of Experiment
1	Sampling and reconstruction of signal using MATLAB
2	To generate and plot discrete time signals.
3	To perform operations on discrete time signals.
4	To compute convolution on discrete time signals.
5	To compute DFT and IDFT of discrete time signals.
6	To determine pole zero plot and inverse Z transform of a signal.
7	To design FIR and IIR filter using FDA Tool.
8	To illustrate signal processing application using SP Tool.
9	To perform upsampling and downsampling on discrete time signal.
10	To study of DSP Starter Kit (TMS 320C6XX DSK).

V Semester

EE2303 –Analog Integrated Circuits & Its Applications

Objective	Course Outcome
1. The objective of this course is to analyze and design a wide variety of operational amplifier / integrated circuits based applications and to have a firm grasp of basic principle of these to adapt to a changing technology as the new devices appear in the market	**On completion of this course,** 1. Student will acquire knowledge of the fundamentals, the different Parameters and internal structure of the operational amplifier. 2. Student will analyze and design the linear applications of the operational amplifier. 3. Students will analyze and design active Butterworth filters using operational amplifier 4. Student will analyze and design the non-linear applications of the operational amplifier.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Student will acquire knowledge of the fundamentals, the different Parameters and internal structure of the operational amplifier.	3													
CO 2	Student will analyze and design the linear applications of the operational amplifier.	2	3	3										2	
CO 3	Students will analyze and design active Butterworth filters using operational amplifier	1	3	3										2	
CO 4	Student will analyze and design the non-linear applications of the operational amplifier.	1	2	3										2	

V Semester

EE2303 –Analog Integrated Circuits & Its Applications

Unit No.	Contents	Max. Hrs.
1	Differential Amplifier, configurations, DC & AC Analysis of DIBO and DIUBO, Differential amplifier using swamping resistor, constant current bias, current mirror, cascaded differential amplifier. DC Level Shifter.	8
2	OPERATIONAL AMPLIFIER FUNDAMENTALS: Block Diagram of Op-AMP, Ideal Op-Amp, OPAMP parameters, Basic Op-Amp Configurations: Open loop, Feedback in OPAMP circuit: Inverting, Non-inverting, voltage follower. Compensation of error parameters :Input Bias and Offset Current, Input Bias and Offset voltages, frequency compensation.	7
3	LINEAR APPLICATIONS : Summing, difference amplifier, integrator, differentiator, Current-to-Voltage Converter, Voltage-to-Current Converter, Instrumentation Amplifiers, Instrumentation Applications, Transducer Bridge amplifiers.Precision Rectifiers, Log/Antilog amplifiers.	7
4	ACTIVE FILTERS: Transfer function, first order filter, Standard second order response, higher order filter, KRC Filters, Multiple feedback filters, second and higher order Butterworth filter design.	8
5	NONLINEAR CIRCUITS: Voltage Comparators, Comparator Applications, Peak Detectors, Schmitt Triggers: Inverting & Non-inverting, Sample-and-Hold Circuits, clipper, clamper, WAVEFORM GENERATORS: multivibrators, triangular wave generator, Sinusoidal Oscillators.	7
6	Phase Locked Loop IC565, Monolithic timer IC555, D-A AND A-D CONVERTERS: Performance Specifications of D-A Converters (DACs) and A-D Converters (ADCs), D-A Conversion Techniques, A-D Conversion Techniques.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Linear Integrated Circuits	3rd Edition	S. Salivahanan, V. S. Bhaaskaran	Tata McGraw Hill Publication
2	Op-amps and Linear Integrated Circuits	3rd Edition	RamakantA.Gayakwad,	Prentice Hall Publication

Reference Books

SN	Title	Edition	Authors	Publisher
1	Linear Integrated Circuits	3rd Edition	D. Roy Chaudhuri, Shail Jain	New Age International
2	Design with Operational Amplifiers and Analog Integrated Circuits	3rd Edition	Sergio Franco	McGraw-Hill

V Semester

EE2304 –Lab: Analog Integrated Circuits & Its Applications

Exp No.	Name of Experiment
1	Verify differential amplifier configurations DIBO and DIUBO using simulation.
2	Verify Gain relationship of Inverting and Non-inverting amplifier and plot frequency response of Non-Inverting amplifier and verify gain bandwidth relation. (Bread-Board and simulation)
3	Determine CMRR and Slew rate of OP-AMP and compare with theoretical values.(Bread-Board and simulation)
4	Verify gain relationship of Summer, Scalar and Subtractor circuits.(Bread-Board and simulation)
5	Determine cut-off frequencies f_a and $f_b$of Integrator using frequency response and verify input output waveforms.(Bread-Board and simulation)
6	Determine cut-off frequencies f_a and $f_b$ofDifferntiator using frequency response and verify input output waveforms.(Bread-Board and simulation)
7	Determine cut-off frequency of second order Butterworth Low pass filter using frequency response and verify order of filter from stop band of frequency response.(Bread-Board and simulation)
8	Determine cut-off frequency of second order Butterworth High pass filter using frequency response and verify order of filter from stop band of frequency response.(Bread-Board and simulation)
9	Verify Comparator operations using single supply op-amp configuration. (Bread-Board and simulation)
10	Verify VUT and VLT of Schmitt trigger using OP-AMP IC 741 and plot the hysteresis curve.(Bread-Board and simulation)
11	Determine frequency of operation and duty cycle of Astable Multivibrator using OP-AMP IC 741.(Bread-Board and simulation)
12	Determine frequency of operation and duty cycle of Astable Multivibrator using IC 555 and modify it for 50% duty cycle.(Bread-Board and simulation)
13	Design a Wein bridge oscillator and study its operation using 741 op-amp.(Bread-Board and simulation)
14	Verify the operation of Half wave and Full wave Precision Rectifier using OP AMP IC 741. (Bread-Board and simulation)

V Semester

EE2311 – PE I: Computer Communication Network

Objective	Course Outcome
1. To learn basics of data communication, wireless transmission, spread spectrum, medium access control- FDMA, TDMA & CDMA. 2. To study TCP/IP, ARP, RARP, UDP protocols & addressing. 3. To study network security & its applications.	**On completion of this course, Students will be able to** 1. Describe various protocols, models in Computer Networks 2. Compare Connectors, Network hardware, Media Types (cables, Wireless) 3. Design, implement and analyze simple computer networks. 4. Apply the different strategies and Operations of TCP/UDP, FTP, HTTP protocols

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Describe various protocols, models in Computer Networks	2	2												
CO 2	Compare Connectors, Network hardware, Media Types (cables, Wireless)	2	2												
CO 3	Design, implement and analyze simple computer networks	2	2												
CO 4	Apply the different strategies and Operations of TCP/UDP, FTP, HTTP protocols	2	2												

V Semester
EE2311 – PE I: Computer Communication Network

Unit No.	Contents	Max. Hrs.
1	Introduction, network and services: communication network, approaches to network design, types of network, two stage and three stage network. Uses of computer networks, LAN, MAN, WAN, design issues for layers, connection oriented and connectionless services, service primitives, Application and layered architecture, OSI reference model.	8
2	LAN network and medium access layer: LAN structure, random access, multiple access protocols, IEEE standard 802 for LAN and MAN, high speed LANS, repeaters, hubs, bridges, fast Ethernet, Wireless LAN	7
3	Physical layer and data link layer: transmission media, PSTN. Data link layer design issues, error detection and correction methods, elementary data link protocols, sliding window protocols.	8
4	Network layer and transport layer: Network layer design issues, routing, congestion, internetworking, transport layer design issues, transport service primitives, internet transport protocol, TCP/IP architecture, TCP/IP protocol, IP packets, IP addressing, TCP/IP utilities ,wireless TCP and UDP, routers and gateways	7
5	Application layer: Network security cryptography, secrete key, public key, digital signature, domain name system, electronic mail system	8
6	Multimedia, real time transport protocol, e-mail security, web security, communication security, electronic mail, world wide web.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Computer Networks	3rd Edition,1996	Tanenbaum	Prentice Hall
2	Data Communications and Networking	4th edition, 2007	Behrouz a Forouzan	Tata Mc. Graw Hill

Reference Books

SN	Title	Edition	Authors	Publisher
1	Data and Computer Communication	8th Edition,2006	W. Stallings	Prentice Hall
2	Telecommunication switching systems and networks	2004.	T. Vishwanathan	Prentice Hall

V Semester
EE2312 – Lab: PE I: Computer Communication Network

Expt. No.	Name of Experiments
1.	To perform stuffing and de-stuffing operation on a given array.
2.	To Perform data encryption and data decryption.
3.	Perform network utility commands.
4.	How to bring two computers in a network.
5.	To study LAN structures.
6.	To configure DNS server.
7.	To configure DHCP server.
8.	Write a program for simple stop n wait protocol.
9.	Write a program for go back n protocol.
10.	Write a program for selective repeat ARQ protocol.

V Semester

EE2313 – PE I: Embedded Systems

Objective	Course Outcome
To provide the acquaintance with 1. Concept of RISC processor, coprocessor, bus structure, memory management. 2. Concept of RTOS &different communication protocols	**On completion of this course, Students will be able to** 1. Understand & Learn concept of Architecture & organization of ARM. 2. Understand & Learn concept of RTOS Architecture. 3. Apply the concept of programming language to interface I/O Devices. 4. Establish the communication between the different Devices.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Understand & Learn concept of Architecture & organization of ARM.	3	3	3											
CO 2	Understand & Learn concept of RTOS Architecture	2	3	3											
CO 3	Apply the concept of programming language to interface I/O Devices.	1	2	3											
CO 4	Establish the communication between the different Devices	1	2	3											

V Semester
EE2313 – PE I: Embedded Systems

Unit No.	Contents	Max. Hrs.
1	Introduction to ARM, Advantages of architectural features of ARM Processor, Processor modes, Register organization, Exceptions and its handling, 3/5- stage pipeline ARM organization	7
2	ARM and THUMB instruction sets, ARM programmer's model, addressing modes, Instruction set in detail and programming, data processing instruction, data transfer instruction, Control flow instructions, simple assembly language programs.	8
3	ARM assembly language programs and C language programs. Code conversion programs.	7
4	LPC 2148 architecture block diagram , pins and signals. GPIO, I / O Interfaces like LED and Switch and their Programs.	7
5	Display interfacing with LPC 2148. 7segment display interfacing. LCD interfacing and programs.	8
6	LPC 2148 TIMER and PWM Applications. Embedded ARM applications	7

Text Books

SN	Title	Edition	Authors	Publisher
1	ARM System–on-chip Architecture	2nd edition, 2000	Steve Furber	Pearson Education Asia
2	Embedded Linux, Hardware, Software and interfacing	2002.	Craig Hallabaugh	Addison-Wesley Professional
3	ARM System Developer's Guide: Designing and Optimizing	2005	Sloss Andrew N, Symes Dominic & Wright Chris	Morgan Kaufman Publication

Reference Books

SN	Title
1	Technical references on www.arm.com.
2	Web base resources for RTOS and µCOS.

V Semester

EE2314 – Lab: PE I: Embedded Systems

Expt. No.	Name of Experiment (Any Ten)
1	To swap data byte
2	To perform addition, subtraction of 16 bit number
3	To find larger of a two numbers.
4	To perform factorial of a given number
5	To perform ON/OFF LED and show status of LED on LCD
6	To display number from 0 to 9 on seven segment display.
7	To ON/OFF LED using Switch.
8	To rotate a stepper motor in clockwise & anti-clock wise direction with equal delay.
9	Perform experiment on DAC of LPC2103
10	ADC and display value on LCD.
11	To find 1's complements of a given number.
12	Study of RTOS
13	device driver for UART.
14	Modify scheduler in such a way that it will assign highest priority to keypad.
15	values from RTC and display on LCD.
16	SMS to any mobile number.
17	Interface pen drive for writing predefined file.

V Semester
EE2315 – PE I: Algorithm & Data Structure

Objective	Course Outcome
1. To Study different Programming Aspect 2. To understand performance of System as per Time and Space Trade-off 3. To learn the various data structures	**On completion of this course, Students will be able to** 1. Study the trade off method Demonstrate and analyze various techniques. 2. Demonstrate various operation on data Structure 3. Understand various types Data Structure 4. Implement various types algorithm and analyze performance of system.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Study the trade off method Demonstrate and analyze various techniques.	3	3	1	1	1									
CO 2	Demonstrate various operation on data Structure	3	3	3	3	2									
CO 3	Understand various types Data Structure	3	3	3	3	3									
CO 4	Implement various types algorithm and analyze performance of system.	3	2	3											

V Semester
EE2315 – PE I: Algorithm & Data Structure

Unit No.	Contents	Max. Hrs.
1	Introduction to Algorithms, Basics of Algorithm, Sub Algorithms, Procedures and Functions, Analysis of Algorithms, Time and Space Complexity, Programming aspects with respect to structured programming, Top down and bottom Up Approach	7
2	Arrays, Operations, Types, Representation of 1D, 2D arrays in memory, Sparse Matrices, Sorting, Quick Sort, Merge Sort, Insertion, Radix, Selection and Bubble Sort, Heap Sort, Searching , Linear, Binary Search, Hashing and collision Handling mechanism.	8
3	Stack , Fundamentals, Operations, Push , Pop , Applications of Stacks, Evaluation of Expressions, Recursion, Stack Machines and Multiple Stacks, Queues , Operations, Add , Delete, Types of Queues , Priority Queues, Circular Queue, Dequeue	7
4	Fundamentals of singly, Doubly, Circular, Linked Stacks and Queues, Examples of Linked List, Circular Linked List, Doubly Linked List and Dynamic Storage Management, Garbage Collection, Compaction and Applications of Linked List, Operations of Polynomials, Generalized Linked List.	8
5	Basic Terminology , Binary Tree Traversals, Threaded Storage Representation, Binary Search Tree, Applications of Tree, Preliminary Treatment of AVL Trees, B-Trees, B+ Trees	7
6	Basic Terminology, Graph Representation, Matrix, List, Multi-List, Graph Traversals, Breath First Search, Depth First Search, Minimum Cost Spanning Trees, Shortest Path Algorithm, Topological Sort, Critical Path.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Data Structures and Program, Design in C	Second Edition	Kruse, Leung and Tondo	PHI
2	Fundamentals of Data Structures	Fifth Edition	Ellis Horowtiz and Sartaj Sahani	Galgotia,Publications

Reference Books

SN	Title	Edition	Authors	Publisher
1	An Introduction to Data Structures with Applications	Second Edition	Tremblay & Sorenson	TMH
2	Data Structures, Schuam Series,	Fifth Edition	Seymour Lipschutz, G.A. V. Pai,	TMH

V Semester
EE2316 – Lab: PE I: Algorithm & Data Structure

Expt. No.	Name of Experiment (Any Ten)
1	Write a program on control Structure & Statements
2	Write a program on If –else structure
3	Write a program on Case Statement
4	Write a program on Functions
5	Write a program on Macros
6	Write a program on Pointers
7	Write a program on Structures
8	Write a program on Linked List
9	Write a program on Doubly linked list
10	Write a program on graphs
11	Write a program on Trees
12	Write a program on Search Algorithms
13	Write a program on Stacks

V Semester

EE2317 – PE I: Applied Machine Learning

Objective	Course Outcome
Students should be able to 1. Understand the concepts of machine learning and regression models 2. Understand the concept of classification for model evaluation. 3. Learn Supervised and unsupervised learning algorithms. 4. Learn the concept of artificial neural network and deep networks	1) Apply the knowledge of Mathematics and programming to build machine learning models 2) Analyze different use cases to evaluate the performance of the models 3) Design and develop application models using supervised and unsupervised learning algorithms 4) Compare different machine learning techniques and demonstrate the comprehension of the trade-offs involved in design choices

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Apply the knowledge of Mathematics and programming to build machine learning models	3	3	1	1	1	-	-	-	-	-	-	3	-	-
CO 2	Analyze different use cases to evaluate the performance of the models	3	3	3	2	3	-	-	-	-	-	-	3	-	-
CO 3	Design and develop application models using supervised and unsupervised learning algorithms	**3**	**3**	**3**	**2**	**3**	**2**	**-**	**2**	**-**	**1**	**-**	**2**	**-**	**-**
CO 4	Compare different machine learning techniques and demonstrate the comprehension of the trade-offs involved in design choices	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**2**	**-**	**1**	**-**	**2**	**-**	**-**

V Semester
EE2317 – PE I: Applied Machine Learning

Unit No.	Contents	Max. Hrs.
1	Supervised and Unsupervised Learning, Regression, Model and Cost Function, Gradient Descent, Multivariate Linear Regression, Feature Scaling, Gradient Descent for multivariable	6
2	Classification, Hypothesis Representation, Decision Boundary, Cost function and Gradient Descent, Multi-classification, Regularization, Model Evaluation	6
3	KNN, SVM, Decision tree,Naive Bayes Classifiers, Random Forest	6
4	K-means clustering, Hierarchical Clustering, DBSCAN Clustering, PCA, Anomaly Detection, Recommender System	6
5	Introduction to neural network, Activation Functions, Perceptron rule, Backpropagation	6
6	Introduction to deep learning, building blocks of CNN, Computational Complexity, Lenet, Alexnet, **New topics to be announced time to time.**	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Understanding Machine Learning. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/copy.html	2017	Shai Shalev-Shwartz and Shai Ben-David.	Cambridge University Press.
2	The Elements of Statistical Learning. https://web.stanford.edu/~hastie/ElemStatLearn/	2009	Trevor Hastie, Robert Tibshirani and Jerome Friedman.	Second Edition
3	Pattern Recognition and Machine Learning. https://www.microsoft.com/en-us/research/people/cmbishop/downloads/	2006	Christopher Bishop.	Springer

Reference Books

SN	Title	Edition	Authors	Publisher
1	Foundations of Data Science.	2017	Avrim Blum, John Hopcroft and Ravindran Kannan.	
2	Learning, Part II, http://www.deeplearningbook.org/	2016	Goodfellow, I., Bengio, Y., Courville, A.	MIT Press
3	Machine Learning: A Probabilistic Perspective	2012	Kevin P. Murphy	MIT Press

V Semester
EE2318 – Lab: PE I: Applied Machine Learning

Expt. No.	Name of Experiment
1.	Data Pre-processing and cleaning
2.	Linear Regression
3.	Non Linear Regression
4.	K-Nearest Neighbours
5.	Decision Tree
6.	Support Vector Machine
7.	K-Means Clustering
8.	Hierarchical Clustering
9.	Content based Recommendation System
10.	Collaborative filtering Recommendation System

V Semester
EE2331 – OE I: Fuzzy Logic & Neural Network

Objective	Course Outcome
1. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory. 2. Introduce students to artificial neural networks and fuzzy theory from an engineering perspective	**On completion of this course, Students will be able to** **CO1:** Understand and learn the basic concepts, working principles of various soft computing techniques, especially Fuzzy logic and Artificial Neural Networks. **CO2:** Analyze the problem statements; provide engineering solutions through development of membership functions / membership graphs, Learning & Recognition approaches **CO3:** Work on Case studies based on Application areas of Soft Computing, Design / Develop and Demonstrate models for Fuzzy controllers, Neural Networks **CO4:** Get involved in self learning approach for developing models using Soft computing techniques, Reveal different applications of these models to solve engineering and other problems and develop solutions for problems related to society and industry needs, writing Technical reports, presentations.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Understand and learn the basic concepts, working principles of various soft computing techniques, especially Fuzzy logic and Artificial Neural Networks.	3	2	1	-	1	1	1	2	1	1	-	1	-	-
CO 2	Analyze the problem statements; provide engineering solutions through development of membership functions / membership graphs, Learning & Recognition approaches	3	3	3	2	2	1	1	2	1	1	-	1	3	-
CO 3	Work on Case studies based on Application areas of Soft Computing, Design / Develop and Demonstrate models for Fuzzy controllers, Neural Networks	3	3	3	3	2	2	1	2	2	2	1	3	3	-
CO 4	Get involved in self learning approach for developing models using Soft computing techniques, Reveal different applications of these models to solve engineering and other problems and develop solutions for problems related to society and industry needs, writing Technical reports, presentations.	3	3	3	3	2	2	1	2	2	2	2	3	3	-

V Semester

EE2331 – OE I: Fuzzy Logic & Neural Network

Unit No.	Contents	Max. Hrs.
1	Crisp sets: An overview, Fuzzy sets: Basic types, basic concepts, basic properties of α-cuts, representation of fuzzy sets, and extension principle of fuzzy sets	8
2	Operations on fuzzy sets, Fuzzy numbers, Arithmetic operations on intervals, arithmetic operations on fuzzy numbers, fuzzy equations	7
3	Fuzzy controllers: an overview with applications, applications of fuzzy logic	7
4	Fundamental concepts of ANN: Basic building blocks of artificial neural networks, network architectures, activation functions, McCulloch-Pitt's neuron model, Learning rules: Hebbian learning rule, Perceptron learning rule, Delta learning (Widrow- Hoff and LMS)rule, Competitive learning rule, Boltzmann learning	8
5	Brief introduction to single layer and multilayer perceptions, ADALINE and MADALINE, feed-forward networks, back propagation networks and applications.	8
6	Radial basis function network, Self organizing feature map and applications	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Fuzzy sets and Fuzzy logic	2008	George J. Klir and Bo Yuan	Prentice Hall
2	Neural Networks: A comprehensive Foundation'	2nd Edition, 2005	Simon Haykin	Pearson publications

Reference Books

SN	Title	Edition	Authors	Publisher
1	Fuzzy sets: Uncertainty & information	1988	Klir and Folger	PHI
2	Introduction of Artificial Neural Networks	1999	Jacek Zurada	Pws Pub Co
3	Fuzzy Logic with engineering applications,	3rd Edition	Timothy Ross,	Wiley Publication
4	Principles of Soft Computing	2nd Edition	S. N. Sivanandanam and S. N. Deepa,	Wiley Publication

V Semester
EE2332 – OE I: Basics of Analog and Digital Communication Systems

Objective	Course Outcome
1. To Study different analog and digital modulation techniques. 2. To understand transmitter & receivers in communication systems	**On completion of this course, Students will be able to** 1. Understand different modulation and demodulation schemes for analog communication with the concept of noise 2. Understand different pulse analog and digital modulation techniques. 3. Understand different digital modulation schemes 4. Understand the different coding techniques for communication systems.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Understand different modulation and demodulation schemes for analog communication with the concept of noise	2	1												
CO 2	Understand different pulse analog and digital modulation techniques.	2	1												
CO 3	Understand different digital modulation schemes	2	1												
CO 4	Understand the different coding techniques for communication systems	2	1												

V Semester

EE2332 – OE I: Basics of Analog and Digital Communication Systems

Unit No.	Contents	Max. Hrs.
1	Basic block diagram of Analog communication system, Modulation techniques: Need for modulation, Basic concepts of AM, FM, PM, Transmitters.	8
2	Receivers: Basic receiver (TRF), Super heterodyne receiver, AM detectors, FM Detectors, Noise Types of Noise, Definition of Noise figure, signal to noise ratio, calculation of noise figure.	7
3	Pulse Modulation: Generation and demodulation of PAM, PWM, PPM, Time division Multiplexing, Frequency division multiplexing, Basic digital Modulation System- PCM.	7
4	Channel capacity, DPCM, Delta Modulation, ADM, ADPCM, Adaptive sub-band coding, applications.	8
5	Digital Modulation techniques: ASK, FSK, PSK, BPSK, QPSK, MSK, DPSK, BFSK, M-ary PSK, FSK, and QAM.	8
6	Source coding and channel coding, Information theory, Huffman coding, LZ coding, Basic concept of convolution code.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Electronic Communication System	Fourth Edition,	Gorge Kennedy	Tata McGraw-Hill
2	Digital Communications	1999	SymonHykin	Wiley, 1988

Reference Books

SN	Title	Edition	Authors	Publisher
1	Electronic Communication Systems	Second Edition, 1993	Frank R. Dungan	Delmar Publishers
2	Communication Electronics	Third Edition, 2007	Louis Frenzel	McGraw-Hill
3	Digital and analog communication systems	Fifth Edition,2003	K. Sam Shanmugam	John Wiley & Sons

V Semester
EE2333 – OE I: Biomedical Instrumentation

Objective	Course Outcome
1. This course is intended for introducing the students to evolution and development of biomedical instrumentation. 2. The purpose of this course is to develop a strong foundation of use of transducers in biomedical measurements. 3. Understand concepts of working principle of various biomedical instruments and analysis their output graphs like ECG,EEG,EMG, X-rays, plethys mograph and spirogyra 4. Understand the fundamentals of Telemedicine like Teleradiology, Telecardiology, Telepsychiatry and Medical Informatics	**On completion of this course, Students will be able to** 1. Describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation 2. Explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram 3. Identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care. 4. Recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation	3	2	1		1									
CO 2	Explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram	3	2	1		1									
CO 3	Identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care.	3	2	1		1									
CO 4	Recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.	3	2	1		3									

V Semester
EE2333 – OE I: Biomedical Instrumentation

Unit No.	Contents	Max. Hrs.
1	Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system.	8
2	Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers	7
3	The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement, Principles of ultrasonic diagnosis, temperature measurement, electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers	7
4	Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG	8
5	Patient care and monitoring, the elements of intensive care monitoring , instrumentation for monitoring patient, pacemakers, defibrillators. Physiological effects of electrical current, shock hazards from electrical equipments.	8
6	Telemedicine concept, Telemedicine applications, video conferencing, digital communication in telemedicine Teleradiology, Tele Cardiology, Telepsychiatry.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Biomedical Instrumentation & Measurement	19 Jan 2010	By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer	Prentice Hall
2	Biomedical Instrumentation	1 Jan 2010	Mandeep Singh	Prentice Hall

Reference books:

1	Handbook of Biomedical Instrumentation	1987	R.S.Khandpur	TMH
2	Bioelectronics Measurement	1983	Dean A Dmane, David Michaels	Prentice Hall
3	Medicine and Clinical Engineering	1 August 2008	Jacobson and Webster	PHI

V Semester
EE2341 – OE II: Data Acquisition & Signal Conditioning

Objective	Course Outcome
The course gives an overview about the data acquisition methods, to acquaint students with ADCs and DACs and various data acquisition techniques	After study through lectures and assignments, Students will be able to: 1. Describe the basic model of data acquisition system and the various methods and attributes of signal conditioning 2. Identify the various types of data acquisition hardware and the serial data communication standards. 3. Distinguish different standards for connection of different programmable instruments like GPIB and SCPI 4. Define use of Ethernet, Medium Access control and USB

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Describe the basic model of data acquisition system and the various methods and attributes of signal conditioning	3	2	2											
CO 2	Identify the various types of data acquisition hardware and the serial data communication standards	2	1	1											
CO 3	Distinguish different standards for connection of different programmable instruments like GPIB and SCPI	3	2	1											
CO 4	Define use of Ethernet, Medium Access control and USB	3	2	1											

V Semester
EE2341 – OE II: Data Acquisition & Signal Conditioning

Unit No.	Contents	Max. Hrs.
1	Definition of data acquisition and control, Fundamentals of data acquisition, Signal conditioning, Data acquisition and control system configuration, Computer plug-in I/O, Distributed I/O, Stand-alone or distributed loggers/controllers, Analog and digital signals: Classification of signals, Sensors and transducers, Transducer characteristics, Resistance temperature detectors (RTDs), Thermistors, Thermocouples, Strain gauges, Wheatstone bridges.	8
2	Signal conditioning: Types and classes, Field wiring and signal measurement, Noise and interference, Minimizing noise, Shielded and twisted-pair cable.	7
3	Plug-in data acquisition boards, A/D Boards, Single ended Vs differential signals, Resolution, dynamic range and accuracy of A/D boards, Sampling rate and the Nyquist theorem, Sampling techniques, D/A boards, Digital I/O boards.	7
4	Serial data communications, Transmission modes – simplex and duplex, RS-232-C interface standard, RS-485 interface standard, Comparison of the RS-232 and RS-485 standards, Serial interface converters, Protocols, Error detection.	8
5	IEEE 488 Standard, Introduction, Electrical and mechanical characteristics, Physical connection configurations, Device types, Bus structure, GPIB handshaking, Device communication, Requirements of IEEE 488.2 controllers, Standard commands for programmable instruments (SCPI).	8
6	Ethernet and field buses for data acquisition, Physical layer, Medium access control, Difference between 802.3 and Ethernet, The universal serial bus (USB), USB overall structure, Topology.	7

Text books:

SN	Title	Edition	Authors	Publisher
1	Data Acquisition for Instrumentation and Control Systems	10 June 2003	John Park and Steve Mackay	Elsevier

Reference books:

SN	Title	Edition	Authors	Publisher
1	Electronic Analog Digital Conversion	1st Edition	H. Schmid	Tata McGraw Hill
2	Data Converters	1st Edition , 1993	B. S. Sonde	Tata McGraw Hill

V Semester
EE2342 – OE II: Microprocessor Programming

Objective	Course Outcome
▪ To understand the architecture, programming and addressing modes of Intel 8085 ▪ To study the instruction set and programming of 8085 ▪ To understand various interfacing of devices for various applications.	Students 1. Will be able to understand the architecture of 8085. 2. Will demonstrate the ability to identify, Formulate and design Program for an assigned task. 3. Will be able to interface Peripheral devices. 4. Will apply the knowledge of microprocessor in their respective field.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Will be able to understand the architecture of 8085.	3	3	3	3										
CO 2	Will demonstrate the ability to identify, Formulate and design program for an assigned task.	2	3	3	2										
CO 3	Will be able to interface Peripheral devices	1	2	3	1										
CO 4	Will apply the knowledge of microprocessor in their respective field.	1	2	3	1										

V Semester
EE2342 – OE II: Microprocessor Programming

Unit No.	Contents	Max. Hrs.
1	Concept of bit, byte & word, Micro Computer organization with I/O devices and memory. Microprocessor, address, data & control bus, RAM / ROM memory.	8
2	Architecture of 8085 Intel microprocessor, Flag Register ,Addressing mode, pins diagram of 8085, Demultiplexing of Address & Data Bus, Generation of various control signals for I/O & Memory Organization	7
3	Basic Instruction set, Subroutine instructions like CALL, PUSH, POP, XTHL instructions and their uses,Programs based on instructions.	7
4	Delay Program,Memory Interfacing - ROM, RAM With 8085, Absolute and Linear decoding techniques.	8
5	MICROPROCESSOR APPLICATIONS - Programmable peripheral IC (8255)- Pin functions, Different Modes & Block Diagram, ADC interfacing , DAC interfacing .	8
6	USART 8251, PIT 8253, Interrupt Structure, Interrupt Controller 8259	7

Text books:

SN	Title	Edition	Authors	Publisher
1	Microprocessor Architecture ,Programming& Interfacing 8085	1 Dec 2000	Ramesh Gaonkar	Penram Publication

Reference books:

SN	Title	Edition	Authors	Publisher
1	8085 Microprocessor	2014	Ajit Pal	Tata Mc-Graw Hill ,
2	Microprocessors & interfacing	2005	D. V. Hall	Tata McGraw-hill

V Semester
EE2343 – OE II: Consumer Electronics

Objective	Course Outcome
➢ To give knowledge and competencies regarding consumer electronic equipments.	Students will be able to 1. Understand the knowledge of the safety aspects in the field of Electrical and Electronics products. 2. Analyze the basics of Audio and Video Systems. 3. Know about recent trends in Processors and computer peripherals, mobile and wireless technologies. 4. Understand the basics of refrigeration cycle and cooling system.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Will be able to understand the architecture of 8085.	3	3	3	3	3									
CO 2	Will demonstrate the ability to identify, Formulate and design program for an assigned task.	2	3	3	2	2									
CO 3	Will be able to interface Peripheral devices	1	2	3	1	1									
CO 4	Will apply the knowledge of microprocessor in their respective field.	1	2	3	1	1									

V Semester
EE2343 – OE II: Consumer Electronics

Unit No.	Contents	Max. Hrs.
1	Standards and Safety norms:Electronics and Electrical safety norms and standards, Electronic products covered under compulsory registration	8
2	Audio Systems: Sound Recording and reproduction, Hi-Fi Sound System, Audio Mixers, Graphics Equalizers, Public Address System.	7
3	Video Systems:Color fundamentals, Luminance and Chrominance signal , Color camera, digital television systems.	7
4	Wireless Technology & Mobile phones:Mobile Phones, various wireless technologies, Introduction to 3G, WiFiTechnology, GSM	8
5	Air conditioner and Refrigerators:Fundamentals, Refrigeration cycles, compressors, home automation	8
6	Computers:Recent microprocessor, Pentium family architecture and salient features , Recent Memories technologies (RAM, HDD), Computer peripherals	7

Text books:

SN	Title	Edition	Authors	Publisher
1	Consumer Electronics	First Edition	S.P. Bali	Pearson Education
2	Consumer Electronics",	2000	B. R. Gupta, Vandana Singhal	S. K. Kataria& Sons,

V Semester

EE2310 – Industry Visit and its Report

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology
SoE & Syllabus 2020
6th Semester
Electronics Engineering

VI Semester
GE2312 - Fundamental of Economics

Objectives	Outcome (Students will be able to)
Recognizes consumer's behavior and pricing.	Relate their buyer behaviour to particular product and the pricing in the market.
Extrapolates an operations in market with productions constrain.	Examine and classify various market structure and factors of production and its role in production process.
Describes the national income accounting and public finance.	Analyse the national income accounting and the various issues related to banking, taxation, and inflation.
Interprets international trade and institutions.	Elaborate about international economics, foreign trade and its agreement, export, foreign exchange and the various international financial institutions.

UNIT-1: Introduction to Economics and Consumers' Behaviors:
Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, exceptions to law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, exception to law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. **(8 Hours)**

UNIT-2: Production and Costs
Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation. **(6 Hours)**

UNIT-3: Market structures - equilibrium output and price
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duopoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination. **(7 Hours)**

UNIT-4: National income accounting:
Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation. **(5 Hours)**

UNIT-5: Money, Banking and Public Finance
Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (GST, Import duties), Revenue and capital expenditure.

(7 Hours)

VI Semester
GE2312 - Fundamental of Economics

UNIT-6: International Trade and Institutions

Definitions of closed vs. open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions. **(5 Hours)**

Text Books:

1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher, 2007

Reference Books:

1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
4. Economics: Samuelson,
5. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
6. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

VI Semester
EE 2351- Control System Engineering

Objective	Outcome
This is a first course in feedback control of dynamic systems. The main goal is to introduce and familiarize students with dynamic systems modeling and analysis techniques that can be employed on a large variety of engineering systems. Being an interdisciplinary course, students will learn: 1 the role of a control engineer in multi-disciplinary teams. 2 to apply the knowledge gained in basic mathematics, physical sciences and engineering courses to derive mathematical models of typical engineering processes. 3 to use transfer function and state space models for control system analysis in time and frequency domain. 4 the importance of stability in control systems and the various methods to determine it. 5 to construct root locus plot and frequency response plots such as polar plot, Bode plot, Nyquist plot etc.	Upon successful completion of this course, students should be able to: 1. Understand the use of block diagram and signal flow graph as a modeling tool and the role of feedback in control systems. 2. Understand the response characteristics of basic first- and second-order dynamic systems. Be able to use Routh's criterion for absolute and relative stability analysis. 3. Construct and recognize the properties of root-locus and its role in the analysis of control systems. 4. Obtain frequency response indices. Be able to draw frequency response plots such as polar plot, Bode plot etc.

Unit I: Introduction to Control Systems:
History of control system, Basic Components of Control System. Open loop control and close loop control with examples. Classification of control systems**, Transfer function, block Diagram and signal flow graph:**-Transfer function and gain. Order of a system. Block diagram algebra & reduction techniques Signal flow graph, its constructions and Mason's gain formula.

Unit II: Mathematical modeling of physical system:
Mathematical modelling of physical system such as –electrical, mechanical, electro-mechanical, thermal, hydraulic, pneumatic etc., Analogous systems,**Characteristics of Feedback Control Systems:** Effect of negative feedback compared to open loop system such as –sensitivity to parameter variation. sensitivity to parameter variation such gain and forward path, Speed of time response, bandwidth, and disturbance rejection., Linearizing effect, Effect of positive feedback.

Unit III: Time Domain Analysis of Control Systems:
Concept of transient response, Steady state response, time response, standard test signals, Time response of first order systems, Transfer function of second order system, Time response of second order system, Time response specifications of second order system, steady state error (ess) analysis, static error constants and system type, dominant poles. Relation between roots of characteristic equation, damping ratio and transient response.

Unit IV: Stability of Linear Control Systems:
Concept of stability, stable, unstable and marginally stable system, Absolutely stable and conditionally stable system, Necessary conditions for stability, method to determine stability, Routh-Hurwitz stability criterion with special cases, relative stability analysis, Routh-Hurwitz stability criterion with special cases, relative stability analysis. State Variable Analysis.

VI Semester
EE 2351- Control System Engineering

Unit V: Root Locus Technique:
Definition, magnitude and angle criteria, properties of root locus, construction rules, for root locus plot of negative feedback systems, determining the gain from root locus plot, effect of addition of poles and zeros of G(s) H(s).

Unit VI: Frequency domain analysis of control systems:
Concept of frequency response and sinusoidal transfer function, resonant frequency, resonant peak, cut off frequency, bandwidth, and correlation between time and frequency response, polar plot, Bode plot, all pass and minimum, log magnitude verses phase plot. **Stability in Frequency domain:**Nyquist stability criteria, concept of gain margin and phase margin and its computation using polar plot and log magnitude verses phase plot. **Lag, lead and lag-lead compensation**

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Control system engineering	5th Edition	I. J. Nagrath& M. Gopal	New Age International
2	Automatic control systems	7thEdition	B. C. Kuo	PHI Learning Private Limited
	Modern control engineering	5th Edition	Katsuhiko Ogata	PHI Learning Private Limited

VI Semester
EE2352- Transmission Lines and Wave Guides

Objective	Outcome
➢ To enable the students, to have a fair knowledge about the theory and problems of EM wave transmission through waveguides and transmission line. ➢ To lay a strong foundation on the theory of transmission line. ➢ To avail deep knowledge and mathematical analysis of Radiation of EM wave, Classification of different types of waveguides and their characterization.	After the completion of course students will able to, 1. Explain fundamental parameters of transmission line and its constraints in high frequency transmission of information. 2. Make use of Transmission line to develop impedance matching networks and any communication system. 3. Relate the propagation characteristics of electromagnetic waves in various wave guide structures. 4. Analyze transmission line using Smith Chart and Design Impedance Matching network.

UNIT-1:
TRANSMISSION LINE THEORY :Different types of transmission lines , Definition of Characteristic impedance ,The transmission line as a cascade of T-Sections Definition of Propagation Constant, General Solution of the transmission line , The two standard forms for voltage and current of a line terminated by an impedance , physical significance of the equation and the infinite line , The two standard forms for the input impedance of a transmission line terminated by an impedance , meaning of reflection coefficient , wavelength and velocity of propagation.

(8 Hours)

UNIT-2:
Waveform Distortion: Distortion less transmission line, The telephone cable, Inductance loading of telephone cables, Input impedance of lossless lines – reflection on a line not terminated by Zo, Transfer impedance reflection factor and reflection loss, T and ∏ Section equivalent to lines.

(7 Hours)

UNIT-3
LINE AT RADIO FREQUENCIES: Standing waves and standing wave ratio on a line , One eighth wave line , The quarter wave line and impedance matching , the half wave line, The circle diagram for the dissipation less line , The Smith Chart , Application of the Smith Chart , Conversion from impedance to reflection coefficient and vice-versa. Impedance to Admittance conversion and vice versa, Input impedance of a lossless line terminated by impedance, single stub matching and double stub matching.

(8 Hours)

UNIT-4:
GUIDED WAVES: Waves between parallel planes of perfect conductors, Transverse electric and transverse magnetic waves, characteristics of TE and TM Waves, Transverse Electromagnetic waves, Velocities of propagation, component uniform plane waves between parallel planes, Attenuation of TE and TM waves in parallel plane guides, Wave impedances.

(7 Hours)

UNIT-5
RECTANGULAR WAVEGUIDES: Transverse Magnetic Waves in Rectangular Wave guides ,Transverse Electric Waves in Rectangular Waveguides ,characteristic of TE and TM Waves , Cutoff wavelength and phase velocity , Impossibility of TEM waves in waveguides , Dominant mode in rectangular waveguide ,Attenuation of TE and TM modes in rectangular waveguides , Wave impedances , characteristic impedance ,Excitation of modes.

(8 Hours)

VI Semester
EE2352- Transmission Lines and Wave Guides

UNIT-6:

CIRCULAR WAVE GUIDES AND RESONATORS: Bessel functions, Solution of field equations in cylindrical co-ordinates , TM and TE waves in circular guides wave impedances and characteristic impedance ,Dominant mode in circular waveguide ,excitation of modes.

(7 Hours)

Text books:				
1	Networks, Lines and Fields	2003	J.D.Ryder	PHI
2	Electro Magnetic Waves and Radiating System	2003	E.C. Jordan and K.G.Balmain	PHI
3	Transmission lines and wave guides	2003	L.Ganesan,S.S.Sreeja Mole	PHI

VI Semester
EE2353- Digital Communication

Objective	Outcome
➢ This course provides compressive coverage of digital communication systems and understanding of the operation of digital modulation schemes.	A student who completes this course will be able to: 1. Learn pulse modulation & discuss the process of sampling, quantization & coding that is fundamental to the digital transmission of analog signals. 2. Understand fundamental concepts & limits in information theory in the context of digital communication theory/ 3. Analyze mathematical model of digital communication systems. 4. Apply error control coding techniques at the receiver.

Unit I: PCM, DM, ADM, DPCM, sub-band and transform coding, model based speech coding like LP coding, CELP coding.

Unit II: Introduction to information theory, entropy, Huffman, Prefix code, and L-Z encoding algorithm, Rate distortion theory for optimum quantization.

Unit III: Gram-Schmitt procedure, Signal space representation of baseband and modulated signals, line coding and baseband digital transmission, Error probability and optimum receivers for AWGN channels, Matched filters.

Unit IV: Digital Modulation techniques, Transmitter, Receiver and signal space representation of BPSK, BFSK,QPSK Introduction to TDM,FDM.

Unit V :Channel capacity Review of channel coding, Linear block codes, cyclic codes, convolution, encoding and decoding, distance properties, Viterbi algorithm and Fano algorithm. Trellis coded modulation methods

Unit VI: Study of PN sequences, direct sequence methods, Frequency hop methods, digital spread spectrum, slow and fast frequency hop, performance analysis, synchronization methods for spread spectrum. Application of spread spectrum, CDMA.

Text books:

1	Digital communication	3rd Edition, 2004	John G Prokis	Springer publication
2	Digital communication	2nd Ed, 2002.	Simon Haykin	John Wiley & sons

Reference books:

1	Modern Communication systems (Principles and application)	6th Edition, 2002	Leon W. Couch	Pearson
2	Digital Communication	5th Edition, 2003.	ShanmughamK.Sam	John Wiely
3	Modern Digital & Analog Communication Systems	3rd Edition, 1999.	B.P.Lathi	Oxford university Press

VI Semester
EE2354- Lab: Digital Communication

Objective	Outcome
This course gives implementation of various modulation techniques, coding, decoding & mathematical modeling using related software.	Students will be able 1. Understand different modulation and demodulation schemes 2. Apply the knowledge of signal space representation 3. Analyze the coding techniques for communication systems. 4. Describe different digital spread spectrum techniques

Expt. No.	Name of Experiment
1	Study of sampling process (MATLAB & Simulink)
2	Study of Pulse Coded Modulation Technique (MATLAB & Simulink)
3	Study of Delta Modulation Technique (MATLAB & Simulink)
4	Calculation of Entropy ,Efficiency,Average code word length,Variance for Huffman Code
5	Gram Schimdtorthogonalization procedure for given set of signals
6	Plot Amplitude Shift Keying, Frequency Shift Keying , Phase shift keying
7	Design of coherent Binary Phase shift keying system
8	Design of coherent Quaternary Phase shift keying system
9	Design of Encoder for Cyclic Hamming Code
10	Convolutional code generation (Time domain & Transform domain approach)

VI Semester
EE2361- PE II: Internet of Things

Objectives	Outcomes
➢ Get acquainted with various IOT environments. ➢ Study IOT architecture and its enabling technologies. ➢ Acquire hands on laboratory experience, utilizing IOT kit.	Upon successful completion of the course, the student will be able to: 1. Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved 2. Understand IoT sensors andtechnological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules 3. Market forecast for IoT devices with a focus on sensors 4. Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi

UNIT-1 :Introduction

Internet of Things Promises–Definition–Scope–Sensors for IoT Applications–Structure of IoT–

(7Hr)

UNIT -2: Connectivity Technologies in IoT

Connectivity Technologies in IoT: MQTT, COAP, XMPP, AMQP, Network Layer: IPv4, IPv6, 6LoWPAN, IoT Communication protocols: IEEE802.15.4, ZigBee, Wireless HART, Zwave, Bluetooth, NFC, RFID

(7Hr)

UNIT -3 : Wireless Sensor networks

Wireless Sensor networks: Components of sensor nodes, Node Behavior in WSNs, Applications, WSN Coverage, OGDC algorithm, Stationary and Mobile Wireless Sensor Networks.

(7Hr)

UNIT -4 : Cloud Computing

Cloud Computing: Characteristics, Components of Cloud Computing, Service Models, Deployment Models, Service Management, Cloud Security, IoT Data analytics, Middleware for IoT.

(7Hr)

UNIT -5 : Machine to Machine Communication

Machine to Machine Communication: Node types, IP and Non-IP based M2M network Interoperability in Internet of Things: Current Challenges in IoT, Interoperability, Types of Interoperability

(7Hr)

UNIT -6: Software-Defined Networking

Software-Defined Networking: Current Network to SDN, SDN Architecture, Challenges, Open Flow Protocol, APIs in SDN, Controller Placement, Recent Advances of SDN in IoT, Industrial internet of things, Case studies.

Text Books:

1. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 -2024',Yole Développement Copyrights ,2014
2. NPTEL course material on Introduction to Internet of Things

REFERENCES

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
2. Editors OvidiuVermesan Peter Friess,'Internet of Things –From Research and Innovation to Market
3. Deployment', River Publishers, 20145.N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014

VI Semester
EE2362- Lab: PE II: Internet of Things

Objective	Outcomes
➢ Get acquainted with various IOT environments. ➢ Study IOT architecture and its enabling technologies. ➢ Acquire hands on laboratory experience, utilizing IOT kit.	Upon successful completion of the course, the student will be able to: 1. Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved 2. Understand IoT sensors andtechnological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules 3. Market forecast for IoT devices with a focus on sensors 4. Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi

Expt. No.	Name of Experiments
1.	Define and Explain Eclipse IoT Project.
2.	List and summarize few Eclipse IoT Projects
3.	Sketch the architecture of IoT Toolkit and explain each entity in brief
4.	Demonstrate a smart object API gateway service reference implementation in IoT toolkit
5.	Write and explain working of an HTTP-to-CoAP semantic mapping proxy in IoT toolkit
6.	Describe gateway-as-a-service deployment in IoT toolkit
7.	Explain application framework and embedded software agents for IoT toolkit
8.	Explain working of Raspberry Pi
9.	Connect Raspberry-Piwith your existing system components
10.	Give overview of Zetta

VI Semester
EE2363- PE II: Digital CMOS Circuits

Objective	Outcomes
➢ To introduce the students to the fundamentals of CMOS circuits. ➢ To understand basic properties of MOS circuits and the design process at gate level and subsystem level. ➢ To give basic understanding of Layout rules.	A student who completes this course will be able to: 1. Describe and interpret the basic concepts of MOS transistors, 2. Construct the ability to design a system, component or process as per needs and specifications. 3. Analyze inverter design, characteristics and applications and performance parameters of CMOS Circuits. 4. Evaluate circuits using different CMOS styles and measure performance of the complex logic structures

UNIT-1: (6 Hours)
Introduction of MOSFETs: CMOS Fabrication Process steps, NMOS Enhancement Transistor, MOS Transistor Operations, PMOS Enhancement Transistor, Regions of Operations, Threshold Voltage, MOS Device Equations, Small Signal Modeling of MOSFETs.

UNIT-2 (6 Hours)
Logic Design With MOSFETs: Ideal Switches and Boolean Operations, MOSFETs as Switches, Basic Logic Gates in CMOS, Compound Gates in CMOS, Transmission Gate Circuits (TG), Pass Transistor.

UNIT-3: (6 Hours)
MOS inverter Characteristics: Resistive load inverter, Inverters with n type MOSFET load, CMOS inverter, Principle of operation, DC characteristics, Tristate Inverter, Noise Margin, Introduction to Bi-CMOS Inverter.

UNIT-4: (6 Hours)
Combinational circuit design, static CMOS, Ratioed Logic circuits, Analysis of CMOS Logic Gates: MOS Device Capacitance, Switching Characteristics, Rise Time, Fall Time, Propagation Delay, Power Dissipation in CMOS, Charge Sharing, Fan-in, Fan-out, Complex Logic Structures, Complementary Static CMOS, Pseudo NMOS Logic, Dynamic CMOS Logic, CMOS Domino Logic, CMOS Pass Transistor Logic

UNIT-5: (6 Hours)
Sequential Circuit Design, Latches and Flip Flops. Advanced Techniques in CMOS Logic Circuits: and Flip-Flops, data path design

UNIT-6: (6 Hours)
Data path VLSI System Components: Comparators, barrel shifters, Multiplexers, Binary Decoders, Equality Detectors and Comparators, Priority Encoders, Shift and Rotation Operations, Bit Adder Circuits,Multipliers.

Text books:				
1	Principle of CMOS VLSI Design	4th Edition, 2013	Neil H. E. WesteHarris	Addison Wesley VLSI Series
2	Introduction to VLSI Circuits and Systems	First Edition	John P. Uyemura	Wiley Publication

Reference books:				
1	CMOS VLSI Design	3rd Edition, 2005	Pucknell , K. Eshraghian	Prentice Hall
2	CMOS Digital Integrated circuits Analysis and Design	Third edition, 2008	Sung-Mo Kang, Yusuf leblebici	TataMcGraw Hill

VI Semester
EE2364- Lab: PE II: Digital CMOS Circuits

Objective	Outcomes
➢ To introduce the students to the fundamentals of CMOS circuits. ➢ To understand basic properties of MOS circuits and the design process at gate level and subsystem level. ➢ To give basic understanding of Layout rules.	A student who completes this course will be able to: 1. Describe and interpret the basic concepts of MOS transistors, 2. Construct the ability to design a system, component or process as per needs and specifications. 3. Analyze inverter design, characteristics and applications and performance parameters of CMOS Circuits. 4. Evaluate circuits using different CMOS styles and measure performance of the complex logic structures

Expt. No.	Name of Experiment (Any Ten)
1	Design of CMOS Inverter using DSCH2 Tool.
2	Gate Level Analysis of 2-Input NAND & NOR Gate.
3	Implement the Following Function using Compound Gates. F(A,B,C,D)=(ABC+CD)'
4	Design Half Adder using NAND Gates.
5	Design Full Adder using NAND Gates.
6	Design 2:1 Multiplexer using NAND Gates.
7	Design 2:4 Decoder using NAND Gates.
8	Design of 4 bit binary Adder
9	Draw Layout of CMOS Inverter Microwind/Cadence Tools
10	Draw Layout of 2-Input NAND Gate using Microwind /Cadence Tools
11	Draw Layout of Multiplexer
12	Design 4 bit adder circuits
13	Design Multiplier circuits

VI Semester
EE2365- PE II: Digital Image Processing

Objective	Outcomes
➢ The objective of this course is to introduce the students to the concepts of Digital Image Processing so that it can be used in advanced studies and projects.	Students will be to 1. Understand the basic concepts of digital image processing and f digital image geometry. 2. Implement the image enhancement and restoration techniques in spatial and frequency domain. 3. Apply and implement image segmentation techniques using edge detection and merging. 4. Apply different Image processing algorithms.

UNIT-1:
Digital image fundamentals : Digital Image through scanner, digital camera, Concept of gray levels, Gray level to binary image conversion, Sampling and quantization, Relationship between pixel, Imaging Geometry.
(8 Hours)

UNIT-2:
Image Transforms: 2-D FFT, Properties, Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform.
(7 Hours)

UNIT-3 :
Image enhancement : Point processing, Histogram processing, Spatial filtering and its frequency domain interpretation. Enhancement in frequency domain, Image smoothing, Image sharpening.
(8 Hours)

UNIT-4:
Image segmentation: Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region oriented segmentation.
(7 Hours)

UNIT-5 :
Image Restoration: Degradation model, Algebraic approach to restoration, Inverse filtering, Least mean square filters, Constrained Least Squares Restoration, Interactive Restoration.
(8 Hours)

UNIT-6:
Image compression: Redundancies and their removal methods, Fidelity criteria, Image compression models, Source encoder and decoder, Error free compression, Lossy compression.
(7 Hours)

Text books:				
1	Digital Image processing	2nd Edition, 2002	R.C. Gonzalez & R.E. Woods	Wesley/ Pearson education
2	Fundamentals of Digital Image processing	1989.	A.K.Jain	PHI
Reference books:				
1	Digital Image processing using MAT LAB	2004	Rafael C. Gonzalez, Richard E Woods and Steven L.	PEA,
2	Digital Image Processing	3rd Edition,2004.	William K. Pratt	John Wilely
3	Fundamentals of Electronic Image Processing	SPIC/IEEE Series,1996	Arthur R. Weeks	PHI

VI Semester
EE2366- Lab:PE II: Digital Image Processing

Objective	Outcomes
➢ The objective of this course is to introduce the students to the concepts of Digital Image Processing so that it can be used in advanced studies and projects.	Students will be to 1. Understand the basic concepts of digital image processing and f digital image geometry. 2. Implement the image enhancement and restoration techniques in spatial and frequency domain. 3. Apply and implement image segmentation techniques using edge detection and merging. 4. Apply different Image processing algorithms.

Expt. No.	Name of Experiment
1	To Explore statistical properties of Image
2	Spatial Image Enhancement
3	Histogram equalisation and modification
4	Image smoothing operations
5	Image Transform : DFT, DCT
6	Bit-plane Slicing
7	Spatial Filtering
8	Frequency Domain Filtering
9	Edge detection
10	Segmentation using threshold
11	Region based segmentation

VI Semester

EE2367- PE II: Object Oriented Programming

OBJECTIVES	OUTCOMES
1. The course aims is to introduce the concept of Object Oriented Programming 2. Demonstrate mastery of object oriented programming concepts: inheritance, polymorphism, and operator overloading. 3. To teach efficient storage mechanisms of data for an easy access 4. Demonstrate pointers, iterators, memory management including object creation and destruction	1. Understand the concept of concepts of Object Oriented Programming. 2. Analyze the using the concept of Inheritance, Polymorphism, Overloading 3. Choose the appropriate data structure and algorithm design method for a specified application. 4. Develop and use linear and non linear data structures and advanced features.

UNIT-1:

Principles of Object Oriented Programming (OOP), Software Evaluation, OOP Paradigm, Basic Concepts of OOP, Benefits of OOP, Application of OOP.

(8 Hours)

UNIT-2:

Introduction to C++, Tokens, Keywords, Identifiers, Variables, Operators, Manipulators, Expressions and Control Structures, Pointers, Functions, Function Prototyping Parameters Passing in Functions, Values Return by Functions, Inline Functions, Friend and Virtual Functions.

(7 Hours)

UNIT-3 :

Classes and Objects, Constructors and Destructors, Operator overloading, Type of Constructors, Function Overloading, Inheritance, Types of Inheritance Virtual Functions and Polymorphism.

(8 Hours)

UNIT-4:

Definition of a data structure, Primitive and Composite data types, Asympotic notations, Arrays, Operations of Arrays, Order lists, Stacks, Applications of Stack, Infix to Postfix Conversion, Recursion, Queues, Operations of Queues.

(7 Hours)

UNIT-5 :

Singly linked list, Operations, Doubly linked list, Operations, Trees and Graphs: Binary tree, Tree traversal; Graph, Definition, Types of Graphs, Traversal (BFS & DFS), Dijkstra`s algorithm

(8 Hours)

UNIT-6:

Files, classes for file stream operations, Opening, Closing and Processing files, End of file detection , File pointes, Updating a file , Error Handling during file operations, Command line arguments, Templates, Exception Handling.

(7 Hours)

Text books:				
1	Object Oriented programming with C++	4th Edition,2008	E. Balagurusamy	TMH
Reference books:				
1	Object Oriented Programming in Microsoft C++	Third Edition, 2003	Robert Lafore	Galgotia publication
2	Fundamental of data structure in C++	2002.	E. Horowitz and S.Shani	Galgotia Pub
3	Computer algorithms	1998.	Horowitz, S.Shani and S.Rajasekaran	Galgotia Pub Pvt Ltd

VI Semester
EE2368- Lab:PE II: Object Oriented Programming

Objective	Outcomes
➢ The course aims is to introduce the students to Object Oriented Programming Concepts memory management including object creation and destruction, and parameter passing in C++.	Students 1. Will learn the basic concepts of Object Oriented Programming. 2. Will design programming the concept of Inheritance, Polymorphism, Overloading 3. Can choose the appropriate data structure and algorithm design method for a specified application. 4. Will be able to use linear and non linear data structures and advanced features of C++ specifically stream I/O, templates and Exception Handling.

Exp No	Name of Experiment
1	Write a function using variables as arguments to swap the values of a pair of integers.
2	Write a program to read the ballot & count the votes cast for each candidate using an array, variable count. In case, a number read is outside the range 1 to 5, the ballot should be considered as a ' spoilt ballot' and the program should also count the number of spoilt ballot.
3	Write a program to read a matrix of size m*n from the keyboard and display the same on the screen.
4	Write a macro that obtains the largest of three numbers.
5	As the practical 4, using inline function. Test the function using the main program.
6	Define a class to represent a bank account including the following members:- Data Members, Member function to display the name and balance.
7	Modify the class and the program of practical 6 for handling 10 customers.
8	Create 2 classes OM and DB which store the value of distance. DM store distances in meters and cm and DB in feet and inches. Write a program that can read values for the class objects and add 1 object OM with another object of DB. Use a friend function to carry out the addition operation the object that stores the results may be a DM object or a DB object, depending upon the units in which the results are require. The display should be in the format of feet and inches or meters and cms depending on the object on display.
9	Write a program for maintaining the inventory of books that are being sold at the shop the Design a system using a class called books with suitable member functions and constructors. Use new operator in constructor to allocate memory space require.
10	Define a class string that could work as a user defined string type include constructors that will enable us to create an .un-initialized string String s1; :/ string with length 0 And also to initialize an object with string constant at the time of creation like String s2("well done"); . Include a function that adds two strings to make a third string.
11	Create a class float that contains 2 float data member. Over load all the 4 arithmetic operators so that do operate on the objects of float.
12	Define 2 classes POLAR and RECTANGLE to represent points in the POLAR and RECTANGLE systems. Use conversion routines to convert from one system to the other.
13	Exercise on file handling

VI Semester
EE2381- OE III : Fuzzy Logic & Neural Network

Objective	Outcome
1. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory. 2. Introduce students to artificial neural networks and fuzzy theory from an engineering perspective	**On completion of this course, Students will be able to** **CO1:** Understand and learn the basic concepts, working principles of various soft computing techniques, especially Fuzzy logic and Artificial Neural Networks. **CO2:** Analyze the problem statements; provide engineering solutions through development of membership functions / membership graphs, Learning & Recognition approaches **CO3:** Work on Case studies based on Application areas of Soft Computing, Design / Develop and Demonstrate models for Fuzzy controllers, Neural Networks **CO4:** Get involved in self learning approach for developing models using Soft computing techniques, Reveal different applications of these models to solve engineering and other problems and develop solutions for problems related to society and industry needs, writing Technical reports, presentations.

UNIT-1:
Crisp sets: An overview, Fuzzy sets: Basic types, basic concepts, basic properties of α-cuts, representation of fuzzy sets, and extension principle of fuzzy sets

(8 Hours)

UNIT-2:
Operations on fuzzy sets, Fuzzy numbers, Arithmetic operations on intervals, arithmetic operations on fuzzy numbers, fuzzy equations

(7 Hours)

UNIT-3 :
Fuzzy controllers: an overview with applications, applications of fuzzy logic

(8 Hours)

UNIT-4:
Fundamental concepts of ANN: Basic building blocks of artificial neural networks, network architectures, activation functions, McCulloch-Pitt's neuron model, Learning rules: Hebbian learning rule, Perceptron learning rule, Delta learning (Widrow- Hoff and LMS)rule, Competitive learning rule, Boltzmann learning

(7 Hours)

UNIT-5:
Brief introduction to single layer and multilayer perceptions, ADALINE and MADALINE, feed-forward networks, back propagation networks and applications.

(8 Hours)

UNIT-6:
Radial basis function network, Self organizing feature map and applications

(7 Hours)

Text books:				
1	Fuzzy sets and Fuzzy logic	2008	George J. Klir and Bo Yuan	Prentice Hall
2	Neural Networks: A comprehensive Foundation'	2nd Edition, 2005	Simon Haykin	Pearson publications

VI Semester
EE2381- OE III : Fuzzy Logic & Neural Network

Reference books:				
1	Fuzzy sets: Uncertainty & information	1988	Klir and Folger	PHI
2	Introduction of Artificial Neural Networks	1999	Jacek Zurada	Pws Pub Co
3	Fuzzy Logic with engineering applications,	3rd Edition	Timothy Ross,	Wiley Publication
4	Principles of Soft Computing	2nd Edition	S. N. Sivanandanam and S. N. Deepa,	Wiley Publication

VI Semester

EE2382- OE III : Basics of Analog and Digital Communication Systems

Objective	Outcome
➢ To Study different analog and digital modulation techniques. ➢ To understand transmitter & receivers in communication systems.	Students will be able to 1. Understand different modulation and demodulation schemes for analog communication with the concept of noise 2. Understand different pulse analog and digital modulation techniques. 3. Understand different digital modulation schemes 4. Understand the different coding techniques for communication systems.

Unit I: Basic block diagram of Analog communication system, Modulation techniques: Need for modulation, Basic concepts of AM, FM, PM, Transmitters.

Unit II: Receivers: Basic receiver (TRF), Super heterodyne receiver, AM detectors, FM Detectors, Noise Types of Noise, Definition of Noise figure, signal to noise ratio, calculation of noise figure.

Unit III: Pulse Modulation: Generation and demodulation of PAM, PWM, PPM, Time division Multiplexing, Frequency division multiplexing, Basic digital Modulation System- PCM.

Unit IV: Channel capacity, DPCM, Delta Modulation, ADM, ADPCM, Adaptive sub-band coding, applications.

Unit V: Digital Modulation techniques: ASK, FSK, PSK, BPSK, QPSK, MSK, DPSK, BFSK, M-ary PSK, FSK, and QAM.

Unit VI: Source coding and channel coding, Information theory, Huffman coding, LZ coding, Basic concept of convolution code.

Text books:				
1	Electronic Communication System	Fourth Edition, 1999	Gorge Kennedy	Tata McGraw-Hill
2	Digital Communications		SymonHykin	Wiley, 1988
Reference books:				
1	Electronic Communication Systems	Second Edition, 1993	Frank R. Dungan	Delmar Publishers
2	Communication Electronics	Third Edition, 2007	Louis Frenzel	McGraw-Hill
3	Digital and analog communication systems	Fifth Edition,2003	K. Sam Shanmugam	John Wiley & Sons

VI Semester

EE2383-OE III: Biomedical Instrumentation

Objective	Outcome
➢ This course is intended for introducing the students to evolution and development of biomedical instrumentation. ➢ The purpose of this course is to develop a strong foundation of use of transducers in biomedical measurements. ➢ Understand concepts of working principle of various biomedical instruments and analysis their output graphs like ECG,EEG,EMG, X-rays, plethysmograph and spirogram ➢ Understand the fundamentals of Telemedicine like Teleradiology, Telecardiology, Telepsychiatry and Medical Informatics	Students will be able to 1. Describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation 2. Explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram 3. Identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care. 4. Recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.

UNIT-1:

Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system.

UNIT-2:

Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers

UNIT-3 :

The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement, Principles of ultrasonic diagnosis, temperature measurement, electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers

UNIT-4:

Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG

UNIT-5 :

Patient care and monitoring, the elements of intensive care monitoring , instrumentation for monitoring patient, pacemakers, defibrillators. Physiological effects of electrical current, shock hazards from electrical equipments.

UNIT-6:

Telemedicine concept, Telemedicine applications, video conferencing, digital communication in telemedicine Teleradiology, Tele Cardiology, Telepsychiatry.

Text Books

SN	Title	Edition	Authors	Publisher
1	Biomedical Instrumentation & Measurement	19 Jan 2010	By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer	Prentice Hall
2	Biomedical Instrumentation	1 Jan 2010	Mandeep Singh	Prentice Hall

VI Semester
EE2383-OE III: Biomedical Instrumentation

Reference books:				
1	Handbook of Biomedical Instrumentation	1987	R.S.Khandpur	TMH
2	Bioelectronics Measurement	1983	Dean A Dmane, David Michaels	Prentice Hall
3	Medicine and Clinical Engineering	1 August 2008	Jacobson and Webster	PHI

VI Semester
EE2391- OE IV : Data Acquisition & Signal Conditioning

Objective	Outcome
The course gives an overview about the data acquisition methods, to acquaint students with ADCs and DACs and various data acquisition techniques	After study through lectures and assignments, Students will be able to: 1. Describe the basic model of data acquisition system and the various methods and attributes of signal conditioning 2. Identify the various types of data acquisition hardware and the serial data communication standards. 3. Distinguish different standards for connection of different programmable instruments like GPIB and SCPI 4. Define use of Ethernet, Medium Access control and USB

UNIT-1:
Definition of data acquisition and control, Fundamentals of data acquisition**,** Signal conditioning, Data acquisition and control system configuration, Computer plug-in I/O, Distributed I/O, Stand-alone or distributed loggers/controllers, Analog and digital signals: Classification of signals, Sensors and transducers, Transducer characteristics, Resistance temperature detectors (RTDs), Thermistors, Thermocouples, Strain gauges, Wheatstone bridges.

(8 Hours)

UNIT-2:
Signal conditioning: Types and classes, Field wiring and signal measurement, Noise and interference, Minimizing noise, Shielded and twisted-pair cable.

(7 Hours)

UNIT-3
Plug-in data acquisition boards, A/D Boards, Single ended Vs differential signals, Resolution, dynamic range and accuracy of A/D boards, Sampling rate and the Nyquist theorem, Sampling techniques, D/A boards, Digital I/O boards.

(7 Hours)

UNIT-4:
Serial data communications, Transmission modes – simplex and duplex, RS-232-C interface standard, RS-485 interface standard, Comparison of the RS-232 and RS-485 standards, Serial interface converters, Protocols, Error detection.

(8 Hours)

UNIT-5
IEEE 488 Standard, Introduction, Electrical and mechanical characteristics, Physical connection configurations, Device types, Bus structure, GPIB handshaking, Device communication, Requirements of IEEE 488.2 controllers, Standard commands for programmable instruments (SCPI).

(7 Hours)

UNIT-6:
Ethernet and field buses for data acquisition, Physical layer, Medium access control, Difference between 802.3 and Ethernet, The universal serial bus (USB), USB overall structure, Topology.

(8 Hours)

Text books:		
1	Data Acquisition for Instrumentation and Control Systems	John Park and Steve Mac

Reference books:				
1	Electronic Analog Digital Conversion	1st Edition	H. Schmid	Tata McGraw Hill
2	Data Converters	1st Edition , 1993	B. S. Sonde	Tata McGraw Hill

VI Semester
EE2392- OE IV : Microprocessor Programming

Objective	Outcome
▪ To understand the architecture, programming and addressing modes of Intel 8085 ▪ To study the instruction set and programming of 8085 ▪ To understand various interfacing of devices for various applications.	Students 1. Will be able to understand the architecture of 8085. 2. Will demonstrate the ability to identify, Formulate and design Program for an assigned task. 3. Will be able to interface Peripheral devices. 4. Will apply the knowledge of microprocessor in their respective field. .

Unit I: Concept of bit, byte & word, Micro Computer organization with I/O devices and memory. Microprocessor, address, data & control bus, RAM / ROM memory.

Unit II: Architecture of 8085 Intel microprocessor, Flag Register ,Addressing mode, pins diagram of 8085, Demultiplexing of Address & Data Bus, Generation of various control signals for I/O & Memory Organization

Unit III: Basic Instruction set, Subroutine instructions like CALL, PUSH, POP, XTHL instructions and their uses,Programs based on instructions.

Unit IV: Delay Program,Memory Interfacing - ROM, RAM With 8085, Absolute and Linear decoding techniques.

Unit V: MICROPROCESSOR APPLICATIONS - Programmable peripheral IC (8255)- Pin functions, Different Modes & Block Diagram, ADC interfacing , DAC interfacing .

Unit VI: USART 8251, PIT 8253, Interrupt Structure, Interrupt Controller 8259

Text books:

SN	Title	Edition	Authors	Publisher
1	Microprocessor Architecture ,Programming& Interfacing 8085	1 Dec 2000	Ramesh Gaonkar	Penram Publication

Reference books:

SN	Title	Edition	Authors	Publisher
1	8085 Microprocessor	2014	Ajit Pal	Tata Mc-Graw Hill ,
2	Microprocessors & interfacing	2005	D. V. Hall	Tata McGraw-hill

VI Semester
EE2393- OE IV : Consumer Electronics

Objective	Outcome
➢ To give knowledge and competencies regarding consumer electronic equipments.	Students will be able to 1. Understand the knowledge of the safety aspects in the field of Electrical and Electronics products. 2. Analyze the basics of Audio and Video Systems. 3. Know about recent trends in Processors and computer peripherals, mobile and wireless technologies. 4. Understand the basics of refrigeration cycle and cooling system.

Unit -I
Standards and Safety norms: Electronics and Electrical safety norms and standards, Electronic products covered under compulsory registration

Unit -II
Audio Systems: Sound Recording and reproduction, Hi-Fi Sound System, Audio Mixers, Graphics Equalizers, Public Address System.

Unit -III
Video Systems: Color fundamentals, Luminance and Chrominance signal , Color camera, digital television systems.

Unit IV
Wireless Technology & Mobile phones: Mobile Phones, various wireless technologies, Introduction to 3G, WiFi Technology, GSM

Unit -V
Air conditioner and Refrigerators: Fundamentals, Refrigeration cycles, compressors, home automation

Unit –VI
Computers: Recent microprocessor, Pentium family architecture and salient features , Recent Memories technologies (RAM, HDD), Computer peripherals , RISC Processor.

Text books:				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Consumer Electronics	First Edition	S.P. Bali	Pearson Education
2	Consumer Electronics",	2000	B. R. Gupta, Vandana Singhal	S. K. Kataria& Sons,

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology
SoE & Syllabus 2020
77th & 8th Semester
Electronics Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	EE2401	Digital System Design	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	EE2402	**Lab.**: Digital System Design	**P**	0	0	2	2	1		60	40	
3	7	PE		Professional Elective-III	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PE		Professional Elective-IV	**T**	3	0	0	3	3	30	20	50	3 Hours
5	7	PE		Lab. : Professional Elective-IV	**P**	0	0	2	2	1		60	40	
6	7	PE		Professional Elective-V	**T**	3	0	0	3	3	30	20	50	3 Hours
7	7	PE		Professional Elective-VI	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	STR	EE2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	EE2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -III

1	7	PE III	EE2411	PE III: Switching Theory & Finite Automata
2	7	PE III	EE2412	PE III :Power Electronics
3	7	PE III	EE2413	PE III: Wireless Sensor Network
4	7	PE III	EE2414	PE III: VLSI Signal Processing

Professional Electives -IV

1	7	PE IV	EE2421	PE IV: Wireless Communication
	7	PE IV	EE2422	**Lab:** PE IV:Wireless Communication
2	7	PE IV	EE2423	PE IV: RF and Microwave
	7	PE IV	EE2424	**Lab:** PE IV: RF and Microwave
3	7	PE IV	EE2425	PE IV: Analog VLSI Design
	7	PE IV	EE2426	**Lab. :** PE IV: Analog VLSI Design
4	7	PE IV	EE2427	PE IV: Operating Systems
	7	PE IV	EE2428	**Lab:** PE IV:Operating Systems

Professional Electives -V

1	7	PE V	EE2431	PE V: Industrial Automation
2	7	PE V	EE2432	PE V: Nano Electronics
4	7	PE V	EE2433	PE V: Optical Communication
5	7	PE V	EE2434	PE V: RF Circuit Design

Professional Electives -VI

1	7	PE-VI	EE2441	PE-VI: E-Commerce and Data Analytics
2	7	PE-VI	EE2442	PE-VI: Micro Electro Mechanical Systems (MEMS)
3	7	PE-VI	EE2443	PE-VI: Biomedical Instrumentation
4	7	PE-VI	EE2444	PE-VI: Computer Organization
5	7	PE-VI	EE2445	PE VI : Introduction to Remote Sensing and Image Analysis

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2020	**1.04**	**Applicable for AY 2020-21 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No.
EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	EE2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	EE2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**84**	**2**	**46**	**132**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

Chairperson	Dean (Acad. Matters)	June 2022	1.05
		Date of Release	Version

Applicable for AY 2022-23 Onwards

VII Semester
EE2401 -Digital System Design

Objective	Outcome
Students should be able to 1. Expose students to the advanced design techniques and methodology and industrial standard EDA tools in Digital Circuits and Systems design	Students will be able to 1. Understand hardware description language and able to design and simulate digital systems using different abstraction levels 2. Design and analyse combinational and sequential logic circuits. 3. Understand and apply timing issues in multiple contexts and design the circuit. 4. Understand programmable devices and able to design digital systems using modern design tools

UNIT-1: HDL Based Design flow, Requirements of HDL, Design Methodologies, Different Modelling styles, Introduction to Verilog, Elements of Verilog, Verilog Module definition, Elements of Module ,Basic Concepts in Verilog, Reserved Keywords, Syntax & Semantics, Comments, Identifiers, Number Representation, System Representation, Verilog Ports, Verilog Data Types, Wire & Variables, Constants, Parameter, Verilog Data Operators.

UNIT-2:, Data Flow Modeling, Delay, Continuous Assignment, Delayed Continuous assignment Design entry in Verilog & Test bench, Combinational blocks design, Compilation and synthesis, Timing analysis resolving signal values

UNIT-3:, Structural Modeling Feature, Module Instantiation, Gate level Primitives, Gate Delays, Switch Level Primitives, User Defined Primitives.

UNIT-4: Behavioral Modeling, Initial, Always, Procedural Assignment, Blocking and Non- Blocking assignments, Sequential & Parallel Blocks, Timing Control, Procedural Statements, Conditional Statements if case loop repeat forever etc, Zero Delay Control, Event Based Timing Control, State Machine Coding ,Moore and Mealy Machines.

UNIT-5 :Combinational & sequential system Design examples like Shift Registers, Counters, LFSR, Latches and Flip Flops , Multi bit Adders examples like Ripple Carry Adder, Carry look ahead adder ,two bit and three bit Multiplier, CPU, Design Verification.

UNIT-6: Introduction to programmable devices, PLA, PAL, PROM, Structure of CPLDs, Introduction to FPGA, Architecture, CLB, IOB, Programmable Interconnect Points, Different type of programmable switches used in PLDs.

Text Books:

	Title	Edition	Author	Publisher
1	Verilog HDL : A Guide to Digital Design and Synthesis	2nd Edition	Samir Palnitkar	2003

Reference Book:

	Title	Edition	Author	Publisher
1	Verilog Digital System Design	Second Edition	Zainalabedin Navabi	Tata McGraw Hill , 2009

VII Semester
EE2402 – Lab.: Digital System Design

Objectives	Outcomes
Students should be able to 1. Expose students to the advanced design techniques and methodology and industrial standard EDA tools in Digital Circuits and Systems design	Students will be able to 1. Understand hardware description language and able to design and simulate digital systems using different abstraction levels 2. Design and analyse combinational and sequential logic circuits. 3. Understand and apply timing issues in multiple contexts and design the circuit. 4. Understand programmable devices and able to design digital systems using modern design tools

Expt. No.	Name of Experiment
1	Write Verilog Codes of basic gates using Bitwise Operator .Test it with test stimuli generated by test bench.
2	Write Verilog Codes of 2:1 and 4:1 Multiplexer using Bitwise Operator .Test it with test stimuli generated by test bench.
3	Write Verilog Codes of 2:4 and 3:8 Decoder using Bitwise Operator .Test it with test stimuli generated by test bench.
4	Write Verilog Codes of half and full adder using Bitwise Operator .Test it with test stimuli generated by test bench.
5	Write verilog code using conditional assignment statement. Test it with test stimuli generated by test bench.
6	Write a Structural Verilog code of full adder using half adder. Test it with test stimuli generated by test bench.
7	Write a Structural Verilog code of 4:1 multiplexer using 2:1 multiplexer. Test it with test stimuli generated by test bench.
8	Write a Structural Verilog code of 4-bit Ripple carry Adder using full adder. Test it with test stimuli generated by test bench.
9	Write a Behavioural Verilog code of multiplexers using if statements. Test it with test stimuli generated by test bench.
10	Write Verilog code for Mealy and Moore sequence detector.(using overlapping allowed and not allowed)

Text Books:

	Title	Edition	Author	Publisher
1	Verilog HDL : A Guide to Digital Design and Synthesis	2nd Edition	Samir Palnitkar	2003

Reference Book:

	Title	Edition	Author	Publisher

1	Verilog Digital System Design	Second Edition	Zainalabedin Navabi	Tata McGraw Hill , 2009

VII Semester
EE2411 – PE III: Switching Theory & Finite Automata

Course Objective	**Course Outcomes**
Students should be able to 1) Understand various sequential logic design methods, Analysis of logic circuits and optimization techniques to minimize gate count. 2) Learn fault diagnosis, Threshold logic, analysis and design of sequential machines.	Students will be able to 1. Design and Analyze multilevel logic Network and Threshold logic for nanotechnologies. 2. Analyze testing of combinational circuits, Fault Models 3. Design and analyze the synchronous and asynchronous sequential circuits. 4. Identify and test the sequential machines with experiments.

UNIT-1

Multi-level logic synthesis, Technology-independent synthesis: Factoring, Decomposition, Extraction, Substitution, and Technology mapping: steps in technology mapping**(06 Hours)**

UNIT-2:

\Threshold logic for nanotechnologies, threshold elements, synthesis of threshold networks: Unate function, Identification & Realization of threshold function. **(06 Hours)**

UNIT-3:

Testing of combinational circuits, Fault models, Structural testing, IDDQ testing, Delay fault testing, Synthesis for testability, Testing for nanotechnologies. **(06 Hours)**

UNIT 4:

Synchronous sequential circuits and iterative networks, memory elements and their excitation functions, synthesis of synchronous sequential circuits, Moore and Mealy machines, finite state machine flow charts, tables **(06 Hours)**

Unit 5:

Asynchronous sequential circuits, Modes of operation, Hazards, Synthesis of SIC fundamental-mode circuits. **(06 Hours)**

Unit 6:

State-identification experiments and testing of sequential circuits, Experiments, Homing experiments, Distinguishing experiments, Machine identification, Checking experiments, Built-in self-test (BIST). New topic to be announced time to time. **(06 Hours)**

Text books:				
1	Switching & Finite Automata Theory	ZviKohavi, Niraja K. Jha	Third Edition 2010	Cambridge University Press
2	Fundamentals of Digital Logic With VHDL Design	Stephen Brown	Second Edition, 2007	TMH

Reference books:				
1	Modern Switching Theory and	Lee S.C		PHI Edition

	Digital Design			
2	Digital Logic and Computer Design	M.Morris Mano		PHI Edition

VII Semester
EE2412 – PE III :Power Electronics

Objective	Outcome
➢ To make familiar with the SCR & other power devices. ➢ To study power controller, various techniques of improving power factor, different methods of commutation. ➢ To understand uncontrolled and controlled converters. ➢ To describe function of various types of an inverter. ➢ To explain operation of choppers.	Students will be able to 1. Understand basic semiconductor physics and properties of power devices for circuit analysis using linear and non -linear operations. 2. Design and Analyze power invertor circuits and learn to select suitable power electronic devices by assessing the requirements of application fields. 3. Formulate analyze and design the converters for various load types. 4. Identify the critical areas in application levels and derive typical alternative solutions, select suitable power converters to control Electrical Motors and other industry grade apparatus.

UNIT-1:
Power Semiconductor Diodes and Circuits, control Characteristics of power devices, power modules, power diodes, reverse recovery, series, shunt connected diodes, Diode Rectifiers-single phase, three phase rectifiers, bride rectifiers, design of rectifiers.

(8 Hours)

UNIT-2:
Power Transistors, Switching characteristics of BJT, Power MOSFETs, IGBTs, limitations, Power Thyristors.

(7 Hours)

UNIT-3
Pulse-width Modulated Inverters: Principle, single phase, multiple phase, PWM Forced commuted inverters, current source inverters, design of inverter, DC-DC Converters, Step up, stepdown, SMPS, thyrister Choppers, design of choppers.

(8 Hours)

UNIT-4:
Resonant Pulse Inverters-Series, parallel, resonant inverters, Class E resonant inverter, Zero voltage/current Switching resonant inverter, Multilevel Inverters.

(7 Hours)

UNIT-5
Controlled Rectifiers: phase control converter, single phase, three phase converters, power factor improvement, AC Voltage Controllers. Principle of ON-OFF control, Phase control, Single phase controllers, three phase controllers, cyclo-converters.

(8 Hours)

UNIT-6:
\Power Supplies, SMPS, SMAC power supplies, power factor conditioning Gate Drive Circuits- Protection of Devices and Circuits Snubber, reverse recovery transients, protection devices varisters, Introduction to AC and DC drives.

(7 Hours)

Text books:

1	Power Electronics: Circuits, Devices and Applications	2nd edition 1993	M. Rashid	PHI
Reference books:				
1	Power Electronics and its application	2nd Edition 2004	Alok Jain	Penram International Publishing Pvt Ltd

VII Semester
EE2413 – PE III: Wireless Sensor Network 7th Semester

Unit I: Introduction & architecture: Motivation of Wireless Sensor Nodes, Challenges, constraints for WSN, applications, single node architecture, Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments

Unit II: Network architecture: Sensor network scenarios, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts

Unit III: communication protocols: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , Contention based Protocols, Schedule based protocols

Unit IV: link layer Protocols: Fundamental, Error Control, Framing, Link Management, Naming And Addressing – Fundamentals, Assignment of MAC Address, Distributed assignment of locally unique addresses, Content based and geographic addressing

Unit V: Naming and addressing, Time synchronization: Properties of Localization and positioning procedures, single hop localization, positioning in multihop environments, and impact of anchor placement. Clustering

Unit VI :Data centric and content based networking:Data centric routing, Data aggregation, Data centric storage, Topology control-controlling topology in a flat network, Hirarical network by dominating set, Hierarchical network by clustering, transport layer and Quality of sevice.

Textbook:

1) Protocols and Architectures for Wireless Sensor Networks. H. Karl and A. Willig. John• Wiley & Sons, June 2005.
2) Fundamentals of wireless sensor networks: Theory and Practice. Waltenegus Dargie,Christian Poellabauer, Wiley & sons, 2010,

Reference books:

1) Wireless Sensor Networks: Technology, Protocols, and Applications. K. Sohraby, D. Minoli, and T. Znati. John Wiley & Sons, March 2007.

VII Semester
EE2414 – PE III: VLSI Signal Processing

Objective	Outcome
Objectives: 1. To learn pipelining & parallel processing techniques. 2. To understand folding & unfolding techniques. 3. To address folding techniques used to design time multiplexed architecture.	**Course Outcome:** By the end of the course, the students shall be able to 1. Design architectures for DSP algorithms. 2. Apply the optimisation concept in terms of area, speed and power on DSP systems. 3. Optimize DSP arithmetic 4. Design of algorithm structure for DSP algorithms based on algorithm transformation.

Unit I: Representations of DSP algorithms: Block diagram, SFG, DFG,DFGrepresentations Loop bound and iteration bound, Algorithms for computing Iteration bound.

Unit II: Pipelining and Parallel Processing: Introduction, pipelining of FIR Digital filters, parallel processing, Pipelining and parallel processing for low power.

Unit III: Retiming:Introduction, Definition and properties, solving system of inequalities, retiming techniques.

Unit IV: Unfolding: Introduction, algorithms for unfolding, Properties of unfolding, Critical path, unfolding and retiming.

Unit V: Folding: Introduction Folding Transformation,Register minimization techniques, Register minimization in folded architectures.

Unit VI: Fast Convolution, Introduction, Cook- Toom algorithm, Winogard algorithm.

Text Books:

1. Keshab K. Parhi. "VLSI Digital Signal Processing Systems" Wiley-Inter Sciences. 1999
2. Mohammed Ismail, Terri, Fiez, "Analog VLSI signal and information processing", McGraw Hill ,1994.
3. Keshab. Parthi, "VLSI Digital signal processing system Design and implementation" Wiley-Inter science, 1999.
4. kung. S.Y., H.J. While house T.Kailath "VLSI and Modern singal processing", prentice hall, 1985.
5. Jose E. France, Yannis Tsividls "Design of Analog Digital VLSI circuits for telecommunications and signal processing" prentice Hall, 1994.

VII Semester
EE2421 – PE V : Wireless Communication

Objective	Outcome
1. To introduce the concepts and techniques associated with Wireless Cellular Communication systems. 2. To provides a comprehensive overview and advanced knowledge of modern mobile and wireless communication systems. 3. To familiarize with state of art standards used in wireless cellular systems.	Students will be able to 1. Describe generations of wireless standard and understand cellular concepts to evaluate the signal reception performance in a cellular network and traffic analysis with given quality of service constraints. 2. Determine the type and appropriate model of wireless fading channel based on the system parameters and the property of the wireless medium. 3. Describe Equalization & Diversity techniques, compare various wireless systems standards. 4. Understand the importance of wireless networking and its applications.

UNIT-1: The Cellular Concept: Evolution of Mobile Radio Communications, Comparison of common wireless communication systems, Examples of wireless communication system,Generations of cellular Networks, Cellular telephone system, frequency reuse, channel assignment and handoff strategies, interference and system capacity, Trunking & grade of service, improving capacity in cellular system.

UNIT-2: Mobile Radio Propagation-large scale path loss : Introduction to Radio Wave Propagation, free space propagation model, Reflection, Diffraction, Scattering, Signal Penetration into Buildings, Ray Tracing & Site Specific Modeling

UNIT-3 : Small Scale fading & Multipath: Multipath Propagation, Small Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types Of Small Scale Fading, Rayleigh &Rician Distribution.

UNIT-4: Equalization & Diversity: Fundamentals of equalization, space polarization, frequency and time diversity techniques, space diversity, polarization diversity, frequency and time diversity. RAKE Receiver.

UNIT-5 : Wireless Systems and Standards: GSM- global system for mobile: services and features, GSM system architecture, GSM radio subsystem, GSM channel types, GSM frame structure, signal processing in GSM, introduction to CDMA digital cellular standard (IS-95).

UNIT-6: Wireless Networking: Introduction to wireless networks, Differences Between Wireless & Fixed Telephone Networks, Development of wireless networks, Traffic routing in wireless networks, Wireless data services, Common channel signalling, Signalling System No. 7.An Example of SS7-Global Cellular Network Interoperability.

Text books:				
1	Wireless Communication – Principles and practice	2nd edition, 2002	T S. Rappaport	Prentice Hall PTR, upper saddle river, New Jersey
2	Mobile Communications – Design fundamentals	2nd edition, 1997	William C. Y. Lee	John Willey

Reference books:				
1	Wireless digital communication : modulation & spread spectrum applications	1995.	KamiloFeher	Prentice Hall PTR; Har/Dis edition
2	Wireless and Cellular Communication	3rd Edition,2005	W .C .Y. Lee	McGraw Hill
3	The Mobile Radio Propagation channel	2nd Edition, 2000	J.D. Parson	John Willey

VII Semester
EE2422 – Lab: PE IV: Wireless Communication

Expt. No.	Name of Experiment
1	Calculation of frequency reuse ratio
2	Design Path loss model
3	To compute the propagation delay for specified source and receiver distance
4	Design frequency selective fading channel characteristic
5	Plot Rayleigh & Rician Distribution
6	Design Equalization model
7	Design of Propagation in transmitter and receiver using ray tracing
8	Data transmission and reception using Time multiple access technique

VII Semester
EE2423 – PE IV: RF and Microwave

UNIT-1: Microwave linear beam tubes (O type): High frequency limitations of conventional microwave devices, Two cavity Klystron Amplifier – Mechanism and mode of Operation, Power output and Efficiency, Applegate diagram, applications, Reflex Klystron Oscillator – Mechanism and mode of Operation Power output, efficiency, mode curve, Electronic Admittance, Modulation of Reflex Klystron; Applications, Helix TWT, BWO. Slow wave structures. **(8 Hours)**

UNIT-2: Microwave cross-field tubes (M Type): Magnetron Oscillator – Hull cut-off voltage, Mechanism of Operation, Mode separation, Phase focusing effect, Power output and Efficiency, Cylindrical magnetron, parallel plate magnetron, split anode magnetron, Types of strapping, Tuning of magnetron. Applications. **(7 Hours)**

UNIT-3 Microwave passive Devices (Reciprocal and non reciprocal):Wave guide Tees - E plane Tee, H plane Tee, Magic Tee and their applications, Directional couplers, Wave guide Corners, Bends and Twists ,Attenuators, Isolators, Gyrators, Circulators, Phase shifter, Rectangular cavity resonator, Transmission line resonators. **(8 Hours)**

UNIT-4: Microwave Network Analysis: Introduction, Symmetrical Z and Y matrices for reciprocal network, Scattering matrix representation of multi port networks, comparison between [S], [Z] and [Y] matrices, Inter relationship between impedance matrix, admittance matrix and Scattering matrix, properties of scattering matrix, Scattering matrix of transmission lines, ABCD parameters with S parameters, Scattering matrix derivation for all components, Numerical Problems. **(8 Hours)**

UNIT-5 Microwave measurement: Introduction, Tunable detector, Slotted line Carriage, VSWR meter, Power measurements sensor, Bolo meter sensor, power sensor, Low and High power measurement, Insertion loss and Attenuation measurement, VSWR measurement – Low and High VSWR, Impedance measurement. Frequency measurement, Measurement of cavity Q, Dielectric measurement, Antenna Measurement – radiation pattern, Phase and gain. Types of Microwave filters: Image parameter method, Insertion loss method. **(7 Hours)**

UNIT-6 Microwave solid state devices and circuits: Microwave diodes – Gun diode – Mode of operation, Crystal diode, PIN diode , Application as Oscillator and Amplifiers, Strip lines: Micro strip lines, parallel strip lines. Coplanar, shielded , Basics of Microwave systems: Radar, RF ID, microwave imaging, modern trends in microwave engineering, effect of microwave on human body. **(8 Hours)**

Text books:				
1	RF Circuit Design Theory And Application	2nd edition, 2011	Ludwig	Pearson Education India
2	Microwave Devices and Circuits	1990	Samueal Liao	Pearson

VII Semester
EE2424 – Lab. : PE IV: RF and Microwave

Expt. No.	Name of Experiment
1	Introduction to Microwave Components.
2	To find the frequency of reflex klystron & Determine electronic and mechanical tuning range.
3	To verify power verses repeller voltage characteristics of reflex klystron.
4	To verify frequency verses repeller voltage characteristics of reflex klystron.
5	To find attenuation of fixed attenuator and To verify the calibration of variable attenuators.
6	To verify the performance of wave-guide tees i) E-plane tee ii) H-plane tee.
7	To verify the performance of E-H plane tee (magic tee).
8	To verify the relationship among free space wavelength, cut off wavelength, guide wavelength
9	To find the Q-factor of absorption type frequency meter and it's insertion loss.
10	To verify the performance of directional coupler i) multi hole ii) cross directional coupler.
11	To determine coupling and isolation of a three port circulator.
12	To determine the gain of pyramidal horn antenna, plot the beam pattern and find the lobe width.
13	To verify characteristics of Gunn diode.
14	To measure the small V.S.W.R. and large V.S.W.R.
15	To measure the V.S.W.R. of an unknown load, and determine impedance using smith chart.
16	To verify various MIC Components.

Text books:

1	RF Circuit Design Theory And Application	2nd edition, 2011	Ludwig	Pearson Education India
2	Microwave Devices and Circuits	1990	Samueal Liao	Pearson

VII Semester
EE2425 – PE IV: Analog VLSI Design

Objectives	Outcomes
• To understand small signal modeling of MOS Transistor. • Perform analysis of single stage amplifier • Analyze amplifier based on frequency response calculation and working principle of one stage, two stage operational amplifier.	Students will be able to 1. Understand small signal model of MOS transistor and Design using SPICE modeling 2. Analyze single stage and differential amplifier with frequency response. 3. Analyze and Design basic analog circuits such as current mirrors, active load, biasing circuits. 4. Illustrate performance parameter of operational amplifier.

Unit I:Basic MOS Device Physics:
Threshold voltage, Derivation of I/V characteristics, second order effects, MOS device capacitance, MOS small signal models, MOS SPICE models.

(6 hours)

Unit II:Single stage amplifiers:
Basic concept, common source, common source stage with resistive load, CS stage with source degeneration, source follower, common gate.

(7 hours)

Unit III: Differential amplifiers:
Single ended & differential operation, Basic differential pair, qualitative and quantitative analysis, Common mode response

(6 hours)

Unit IV:
Passive and active current mirrors:
Basic current mirror,Cascode current mirror, Active current mirror,common mode properties

(6 hours)

Unit V: frequency response of amplifiers:
Miller effect, association of poles with node, common source stage , source follower, common gate stage

(7 hours)

Unit VI: Operational amplifiers:
Performance parameters, one stage op amp, Two stage op amp, Gain boosting, Noise in op amp

(6 hours)

Text books:				
1	Design of Analog CMOS Integrated circuits	Ninteenth reprint 2010	BehzadRazavi	Mc-graw-Hill

Reference books:				
1	CMOS circuit design, layout, and Simulation'	Second edition, reprint 2009.	Jacob Baker	WSE
2	CMOS Analog Circuit Design	second edition, 2010	P.E.Allen, D.R.Holdberg	Oxford univ. press
3	Analysis and Design of Analog Integrated Circuits	fifth edition, reprint 2010	Paul B Gray , Hurst , Lewis, Meyer	John Wiley & sons

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester

EE2426 – Lab. : PE IV: Analog VLSI Design

OBJECTIVES	OUTCOMES
➢ To introduce the students to the fundamentals of CMOS circuits. ➢ To learn the modeling of circuits, circuit characterization and performance extraction. ➢ To understand basic electrical properties of MOS circuits and the design process at gate level and subsystem level. ➢ To give basic understanding of various analyses of differential amplifiers. ➢ To give basic understanding of non linear circuits such as comparator design.	Students will be able to 1. Understand small signal model of MOS transistor and Design using SPICE modeling 2. Analyze single stage and differential amplifier with frequency response. 3. Analyze and Design basic analog circuits such as current mirrors, active load, biasing circuits. 4. Illustrate performance parameter of operational amplifier.

Expt. No.	Name of Experiment
1	NMOS characteristic :- VdsVs ID for various values of Vgs.
2	PMOS characteristic :- VdsVs ID for various values of Vgs.
3	Current source using current mirror :- DC analysis
4	Common Source amplifier:- AC analysisTransientanalysis
5	Common Drain amplifier:- AC analysisTransientanalysis
6	Differential Amplifier :- AC analysis Transfer curve (Vin VsVout, DC condition)
7	Op-Amp Design: AC analysis Transient analysis DC analysis
8	SPICE simulation of basic analog circuits, Analog Circuit simulation Verification of layouts.
9	Basic CMOS Comparator Design
10	Source Coupled Pair Differential Amplifier

Text books:				
1	Design of Analog CMOS Integrated circuits	Ninteenth reprint 2010	BehzadRazavi	Mc-graw-Hill

Reference books:				
1	CMOS circuit design, layout, and Simulation'	Second edition, reprint 2009.	Jacob Baker	WSE
2	CMOS Analog Circuit Design	second edition, 2010	P.E.Allen, D.R.Holdberg	Oxford univ. press
3	Analysis and Design of Analog Integrated Circuits	fifth edition, reprint 2010	Paul B Gray , Hurst , Lewis, Meyer	John Wiley & sons

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester
EE2427 – PE IV: Operating Systems

Objective	Outcome
1. To have an overview of different types of operating systems 2. To know the components of Operating systems 3. To have through knowledge of process management 4. To have through knowledge of storage management	1. Understand the concepts of operating systems and processes 2. Learn processes, threads and memory management and storage structures 3. Evaluate the algorithms and solutions for operating system management 4. Analyze the security issues in operating systems

UNIT-1:
Computer System organization ,Architecture, Structure, Operations, Process Management, Memory Management, OS Services, User Operating System Interface, System Calls, System Programs

(8 Hours)

UNIT-2:
Process Concept, Scheduling, Operations, Scheduling Criteria, Scheduling Algorithms, Tread Scheduling, Multiple Processor Scheduling

(7 Hours)

UNIT-3 :
Synchronization, Critical Section Problem, Semaphores, Deadlocks, System Models, Characterization, Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance

(8 Hours)

UNIT-4:
Memory Management Strategies, Swapping, Continuous Memory Allocation, Paging, Segmentation , Virtual Memory Management, Demand Paging, Page Replacement, Trashing,

(7 Hours)

UNIT-5 :
File System Concept, Access Methods, Directory and Disk Structure, Mounting, Sharing, Mass Storage Structure, Disk Attachment, Scheduling, RAID Structure

(8Hours)

UNIT-6:
Protection and Security , Domain of Protection, Access Matrix, Access Control, Language based Protection, Security Problem, System and Network Threats, Cryptography as Security Tool

(7 Hours)

Text books:				
1	Operating System Concepts	Eigth Edition, 2012	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne	John Wiley & Sons (ASIA) Pvt. Ltd
2	Modern Operating Systems	2003.	Andrew S. Tanenbaum	Prentice Hall of India Pvt. Ltd
Reference books:				
1	Operating Systems	2002	Harvey M. Deitel	Pearson Education Pvt. Ltd
2	Operating System	4th Edition, 2003	William Stallings	Prentice Hall of India
3	An Introduction to Operating Systems, Concepts and Practice	2003	Pramod Chandra P. Bhatt	PHI,

VII Semester
EE2428 – PE IV: Lab.: Operating Systems

Objective	Outcome

1. To have an overview of different types of operating systems 2. To know the components of Operating systems 3. To have through knowledge of process management 4. To have through knowledge of storage management	1. Understand the concepts of operating systems and processes 2. Learn processes, threads and memory management and storage structures 3. Evaluate the algorithms and solutions for operating system management 4. Analyze the security issues in operating systems

Expt. No.	Name of Experiment
1	Implement process system calls
2	Thread management
3	Thread synchronization
4	Deadlock Avoidance Using Semaphores
5	Linux Kernel configuration, compilation and rebooting from the newly compiled kernel.
6	Inter process communication in Linux
7	Implementing a CPU scheduling
8	Implementing a file system
9	Implement process system calls

Text books:				
1	Operating System Concepts	Eigth Edition, 2012	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne	John Wiley & Sons (ASIA) Pvt. Ltd
2	Modern Operating Systems	2003.	Andrew S. Tanenbaum	Prentice Hall of India Pvt. Ltd
Reference books:				
1	Operating Systems	2002	Harvey M. Deitel	Pearson Education Pvt. Ltd
2	Operating System	4th Edition, 2003	William Stallings	Prentice Hall of India
3	An Introduction to Operating Systems, Concepts and Practice	2003	Pramod Chandra P. Bhatt	PHI,

VII Semester
EE2431 – PE V: Industrial Automation

Objective	Outcome

Unit -1

Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems

Unit-II

Automation components: Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.

Unit-III

Computer aided measurement and control systems: Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking,

Unit-IV

Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation

Unit-V

Programmable logic controllers: Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

Unit-VI

Distributed Control System: Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS

Text Book

- Industrial Instrumentation and Control By. S.K. Singh The McGraw Hill Companies

VII Semester
EE2432 – PE V: Nano Electronics

Objective	Outcome

Unit -1

Introduction to Nanoelectronics, CMOS Technology scaling issues, Short channel effects, sub-threshold conduction, Drain Induced Barrier Lowering, Design techniques for nanoscale transistor

Unit-II

MOS Electrical Characterization, Ideal MOS C-V Characteristics, Effects on non idealities on C-V, MOS Parameter extraction, Overview of Non Classical MOSFETs and carrier transport in Nano MOSFETs, Ballistic Transport

Unit-III

Silicon on Insulator (SOI) MOSFET, SOI technology comparison with bulk silicon CMOS Technology, Partially Depleted (PD) and Fully Depleted (FD) SOI-MOSFETs, Metal Semiconductor contacts and Metal-Source / Drain Junction MOSFETs

Unit-IV

Germanium and Compound semiconductor Nano MOSFETs, Germanium as alternative to silicon , Compound semiconductors, GaAs MESFETs types, Introduction to Nanomaterials

Unit-V

Quantum Mechanics and Quantum Statistics for considering nanomaterials, Basic principles of quantum mechanics , Energy bands in crystalline solids, Synthesis / Fabrication of Nanomaterials / structures, nanowires

Unit-VI

Chemical vapor deposition (CVD) and atomic layer deposition (ALD) , Carbon nanostrucutes, Characterization of Nanomaterials and Nanostructures

Text Book

- Fundamentals of Modern VLSI Devices, Y. Taur and T. Ning, Cambridge University Press

VII Semester
EE2433 – PE V: Optical Communication

Objective	Outcome
➢ To learn the basic elements of optical fiber transmission link, fiberglass modes configurations and structures. ➢ To understand different kinds of losses, signal attenuation in optical fibers & other dispersion factor. ➢ To learn various optical sources, LED/LASER structures, receivers (PIN, APD), and noise performance. ➢ Understanding of optical network system components, variety of networking aspects, SONET/SDH and operational principles WDM.	This course enables the students to: 1. Understand the fundamental principles of optics and light wave to design optical fiber communication systems. 2. Differentiate the types of losses in optical fiber link. 3. Analyze different types of sources & detectors in fiber optics. 4. Explore different methods of loss measurement in fiber optics.

UNIT-1: INTRODUCTION TO OPTICAL FIBERS

Evolution of fiber Optic system. Principle of optical communication-Attributes and structures of various fibers such as step index, graded index mode and multi modefibers. Propagation in fibers-Ray mode, Numerical aperture and multipath dispersion in step index and graded index fibers structure.

(8 Hours)

UNIT-2:SIGNAL DEGRADATION IN OPTICAL FIBERS

Attenuation, Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Group Delay, Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers, Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers, Mode Coupling, Design Optimization of SM fibers, RI profile and cut-off wavelength.

(7 Hours)

UNIT-3 : FIBER OPTICAL SOURCES

Direct and indirect Band gap materials, LED structures, Light source materials, Quantum efficiency and LED power, Modulation of a LED, Laser Diodes , Modes and Threshold condition, Rate equations, External Quantum efficiency, Resonant frequencies, Laser Diodes structures and radiation patterns, Single Mode lasers, Modulation of Laser Diodes, Temperature effects, Fabry Perot cavity Quantum laser

(8 Hours)

UNIT-4: FIBER OPTICAL RECEIVERS

PIN and APD diodes , Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise ,Comparison of Photo detectors, Fundamental Receiver Operation, Error Sources, Receiver Configuration, Probability of Error, The Quantum Limit, Noise Effects on System Performance, Eye diagram.

(7 Hours)

UNIT-5 : DIGITAL TRANMISSION SYSTEM

Introduction of fibers cables, Fiber Splicing and connectors, Operational Principals of WDM, SONET, LAN 1000 baseSX, LX and Passive Components, Optical TDM.

(8 Hours)

UNIT-6:MEASUREMENT IN OPTICAL FIBERS

Attenuation, Time domain dispersion and Frequency domain dispersion, OTDR, NA measurement Refractive index profile and optical source characteristic measurements.

(7 Hours)

Text books:				
1	Optical Fiber Communication	3rd edition, 1999.	Gerd Keiser	McGraw-Hill Science/Engineering /Math
2	Optical Communication, Principles and Practice	2nd Edition,1994	J.Senior	Prentice Hall of India

Reference books:				
1	Optical Communication System	2001	J.Gower	Prentice Hall of India
2	Fiber-Optic Communication System	Third Edition, 2009.	GovindAgrawal	John Willy & Sons

VII Semester
EE2434 – PE V: RF Circuit Design

Unit – I Introduction, Importance of Radio frequency Design, RF Behaviour of Passive Components, Chip Components, Transmission Line Analysis, Equivalent Circuit Representation, Circuit Parameters for a Parallel Plate Transmission Line, Microstrip Transmission Line, Terminated Lossless Transmission Line, Special Termination Conditions, Sourced and Loaded Transmission Line.

Unit – II The Smith Chart, From Reflection Coefficient to Load Impedance, Impedance Transformation, Admittance, Transformation, Parallel and Series Connections, Single- and Multiport Networks, Interconnecting Networks, Network Properties and Applications, Scattering Parameters.

Unit – III An Overview of RF Filter Design, Basic Resonator and Filter Configurations, Special Filter Realizations, Filter Implementation, Coupled Filter.

Unit – IV Matching and Biasing Networks: Impedance Matching Using Discrete Components, Microstrip Line Matching Networks, Amplifier Classes of Operation and Biasing Networks.

Unit – V RF Transistor Amplifier Designs: Characteristics of Amplifiers, Amplifier Power Relations, Stability Considerations, Constant Gain, Noise Figure Circles, Constant VSWR Circles, Broadband, High-Power, and Multistage Amplifiers

Unit – VI Oscillators, Basic Oscillator Model, High-Frequency Oscillator Configuration, Oscillators describing functions, Colpitt"s oscillators Resonators, Tuned Oscillators, Negative resistance oscillators, Phase noise Basic Characteristics of Mixers. Non-linear based mixers, Quadratic mixers, Multiplier based mixers, Single balanced and doubles balanced mixers, sub sampling mixers.

Text book

1. "RF Circuit Design – Theory and Applications", Reinhold Ludwig and Pavel Bretchko, 2nd Edition, Pearson Education, 2000.

Reference books:

1. T.Lee, "Design of CMOS RF Integrated Circuits", Cambridge, 2004.
2. B.Razavi, "RF Microelectronics", Pearson Education, 1997. 4. B.Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2001

VII Semester
EE2441 – PE-VI: E-Commerce and Data Analytics

Objective	Outcome
The student should be able to 1) To understand the scope of e-commerce in the realm of modern Business. 2) To learn the marketing methods& Business strategies used in e-commerce. 3) To know how the electronic data interchange and how to manage commerce solutions 4) Understand the security threats &electronic payment system	On completion of this course, the student will be able to 1. Understand of contemporary ecommerce concepts and terminology, and the processes and management decisions that are involved in launching, operating and managing business activity on the World Wide Web. 2. Analyze and understand the human, technological and business environment associated with e-commerce. 3. Define and analyze the concept of electronic data interchange and its legal, social and technical aspects. 4. Define and analyze the security issues over the web, the available solutions, future aspects of e-commerce security, concept of E-commerce and electronic payment system

UNIT I:

Internet &Introduction to Electronic Commerce: Introduction to Traditional commerce and E commerce The basics of internet access, email, FTP, TELNET, Introduction to WWW: The basics of WWW & browsing working of Web Browser & Web Server, Web Browser architecture. Introduction to Electronic Commerce: The scope of Electronic Commerce, Definition of Electronic Commerce, Electronic Commerce and the Trade Cycle, Electronic Markets, Electronic Data Interchange, Internet Commerce, Advantage and disadvantages of e-Commerce.

UNIT II:

Business Models of e – commerce and Strategy: Model Based on Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C. Strategic Methods for developing E -commerce, the Value Chain System. Porters value chain Model.

UNIT III:

E-commerce Payment Systems (EPS) :- Payment through card systems, E – Cheque, E – Cash, E – Payment Threats & Protections. e-credit accounts, e-money, marketing on the Web, Marketing strategies, Advertising on the Web, Customer service and support, Introduction to m-commerce, Case study: e-commerce in passenger air transport.

UNIT IV:

E – Marketing And Electronic Data Interchange (EDI): Home –shopping, E-Marketing, Tele-marketing. Electronic Data Interchange (EDI): Concepts, Benefits and Applications; EDI Model, EDI Protocols (UN EDI FACT).

UNIT V:
The Elements of e-Commerce& e-Business: Elements, e-Visibility, The e-shop, Online Payments, Delivering the Goods, After-Sales Service. e-Business: Introduction, Internet Bookshops, Software Supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the Net.

UNIT VI:
Overview, Security for E – Commerce, Security Standards, secure electronic payment protocols, Password Systems, Digital certificates, Digital signatures

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	E-Commerce	2001	David Whiteley	McGrew Hill Pub
2.	Electronic Commerce	2nd Edition	Gary P. Schneider & James T. Perry	Course Technology

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Teach Yourself Web Technologies -Part 1	2003	Ivan Bayross	BPB Publications
2	Web Technologies TCP/IP Architecture, and Java Programming	2nd Edition	Achyut S. Godbole and Atul Kahate	McGraw-Hill Education (India)

VII Semester
EE2442 – PE-VI: Micro Electro Mechanical Systems (MEMS)

Objective	Outcome
➢ Standard micro fabrication techniques and the issues surrounding them ➢ Major classes, components, and applications of MEMS devices/systems and to demonstrate an understanding of the fundamental principles behind the operation of these devices/systems ➢ Micro fabrication techniques and applications to the design and Manufacturing of an MEMS device or a Microsystems ➢ Foster interest for further study	Students will be able to: 1. Understand working principles of MEMS technology. 2. Learn the basic principles and applications of Micro fabrication and micromachining processes. 3. Discuss various applications of RF MEMS. 4. Classify types of microsensors and micro actuators used in Micro systems

UNIT I

Introduction to MEMS: Benefits of Miniaturization, Types of MEMS: Optical MEMS, Bio- MEMS, RF- MEMS, Microfludics, Success Stories, Pressure sensor, Accelerometer, Micro-mirror TV Projector

UNIT II

Microfabrication and Micromachining: Integrated Circuit Processes, Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding, High Aspect-Ratio Processes (LIGA), MEMS Device fabrication using Bulk Micromachining

UNIT III

Surface Micromachining: One or two sacrificial layer processes, Surface micromachining requirements, Device fabrication using Surface Micromachining example, Microcantilever fabrication

UNIT IV

RF MEMS Devices: Capacitor, Inductor, Switches, and antennas, RF MEMS components in communications, space and defense applications

UNIT V

Physical Micro sensors: Classification of physical sensors, Integrated, Intelligent, or Smart sensors, Sensor Principles and Examples: Thermal sensors, Electrical Sensors, Mechanical Sensors, Chemical and Biosensors

UNIT VI

Microactuators: Classification of microactuators, Electrostatic, Electromagnetic and Thermal microactuation, Mechanical design of microactuators, Microactuator examples, microvalves, micropumps, micromotors.

Text Books:

1. Micro and Smart Systems: Ananthasuresh, G. K., Vinoy, K. J., Gopalakrishnan, S., Bhat, K. N., and Aatre, V. K., Wiley-India,NewDelhi, 2010.

Reference Books:

1. VLSI Technology, Sze S.M. (ed),McGraw Hill
2. RF MEMS and Their Applications: Vijay Varadan, K. J. Vinoy, K. A. Jose, Wiley, 2002.

VII Semester
EE2443 – PE-VI: Biomedical Instrumentation

Objective	Outcome
➢ This course is intended for introducing the students to evolution and development of biomedical instrumentation. ➢ The purpose of this course is to develop a strong foundation of use of transducers in biomedical measurements. ➢ Understand concepts of working principle of various biomedical instruments and analysis their output graphs like ECG,EEG,EMG, X-rays, plethysmograph and spirogram ➢ Understand the fundamentals of Telemedicine like Teleradiology,Telecardiology, Telepsychiatry and Medical Informatics	Students 1. Will be able to understand the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation 2. Will be able to understand cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram 3. Will be able to understand various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care. 4. Will be able to understand concept of Telemedicine, its applications and use of internet resource for hospital management system.

UNIT-1:
Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system

UNIT-2:
Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers

UNIT-3 :
The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement. Principles of ultrasonic diagnosis, temperature measurement.

UNIT-4:
Electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers.

UNIT-5:
Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG pacemakers, defibrillators. Physiological effects of electrical current, shock hazards from electrical equipment, Methods of accident prevention. Tomograpghy, MRI.

UNIT-6:
Telemedicine, Telemedicine applications, video conferencing, digital communication in telemedicine, Teleradiology, Tele Cardiology, Telepsychiatry, Hospital Information System, Computer Networks in Health care.

Text books:				
1	Biomedical Instrumentation & Measurement		By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer	PHI
Reference books:				
1	Handbook of Biomedical Instrumentation		R.S.Khandpur	TMH
2	Bioelectronic Measurement		Dean A Dmane, David Michaels	Prentice Hall
3	Medicine and Clinical Engineering		Jacobson and Webster	PHI
4	Introduction to Biomedical Equipment Design		Carr and Brown	John Wiley
5	Biomedical Digital Signal Processing		Tompkins	

VII Semester
EE2444 – PE VI : Computer Organisation

Objective	Outcome
➢ Acquire knowledge of various Computer architecture. ➢ To understand Processor level design, controller design of processor. ➢ To understand memory organization of computer. ➢ To Learn about DMA operation, parallel processing architecture.	After study through lectures and assignments, Students will be able to: 1. Understand design levels of a computer system, System organization, memory hierarchy and virtual memory concept 2. Understand the operation of fixed- and floating-point arithmetic units. 3. Analyze hierarchical design of processor and control unit modules. 4. Apply the concepts of pipelining and multiprocessing for computer system design.

UNIT-1:
Register Level Design – General characteristics, Description, Languages, Combinational and sequential components, Design methods, Processor Level design- components, design techniques. (7 Hours)

UNIT-2:
Processor Design- Processor organization, information representation, number Formats. Instruction sets – Instruction formats, instruction types, multiplication & division ALU design, Floating Point arithmetic, IEEE 754 floating point formats. (8 Hours)

UNIT-3
Control design – Instruction sequencing, interpretation, Hard-wired control-Design methods, multiplier and CPU control unit, Micro programmed control – Basic concepts, minimizes microinstruction size, multiplier control unit, Micro programmed Computers – CPU control unit,.(8 Hours)

UNIT-4:
Memory organization – Device characteristics, RAM, Serial access memories, virtual memory, concept of cache & associative memories. (7 Hours)

UNIT-5
System Organization – Local and long distance communication input-output systems, Interrupt, DMA, introduction to parallel processing. (8 Hours)

UNIT-6:
Concept of parallel processing, Pipelining, vector processors, introduction of RISC architecture, Date Flow architecture. (7 Hours)

1	Computer Architecture and organization	Third Edition, 1997	Jhon.P. Hayes	McGraw-Hill Companies
Reference books:				
1	Computer organization	Fifth edition, 2001	Carl Hammacher	McGraw-Hill Science
2	Structured computer and Organization	Fifth edition, 2005	Andrew S. Tanenbaum	PHI
3	computer organization and microprogramming	First edition, 1972.	CHU, YAOHAN	Prentice Hall
4	Computer System Architecture	Third Edition ,1992	M.Morris Mano	Prentice Hall

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester
EE2445 – PE VI: Introduction to Remote Sensing and Image Analysis

Course Objective	Course Outcome
Course Objective Students should be able to 1) Understand Remote Sensing & sensor Concepts 2) Understand the fundamentals and image characteristics of remote sensing. 3) Learn image enhancement techniques 4) Study image classification technique and hyperspectral image analysis	**Course Outcome** Students will be able to 1) Comprehend the basic and applied principles of remote sensing, RS image characteristics 2) Understand and evaluate image spatial and spectral transforms and their effect on image quality and data integrity 3) Apply the image correction techniques and classification algorithms on remote sensing images 4) Analyze high-dimensional remote sensing imagery with appropriate remote sensing data and processing methods.

UNIT-1: Remote Sensing Concepts Review of Remote Sensing Concepts: spatial and radiometric characteristics – spectral and temporal characteristics, Optical Radiation Model: The wave/ particle models - energy/matter interaction – Radiometric Correction–Atmospheric Correction, Image sensors
UNIT-2: Digital Image Formation and Characteristics Digital Image Formation: point spread functions – sampling and quantization Digital Image Characteristics: Univariate and multivariate image statistics – noise models- power spectral density- co-occurrence matrix
UNIT-3: Image Enhancement and Spectral Transforms Contrast enhancement – band rationing – principal component analysis – vegetation transforms – texture transforms, Spatial Transforms: convolution concept - low and high pass filtering – spatial transformations – Fourier transform
UNIT 4: Geometric Correction Sensor geometry and empirical models for geometric corrections techniques. Distortion Correction, Sensor compensation, Noise reduction, Radiometric Calibration

Unit 5: RS Image Classification Thematic Information Extraction: review of supervised and unsupervised Image classification – Maximum Likelihood and Bayesian classification, Non-parametric & parametric classification
Unit 6: High Dimension Image Analysis Subpixel classification: Linear mixing model, fuzzy set classification, Hyperspectral Image Analysis: Feature extraction, classification algorithms for hyperspectral data, Applications of Remote Sensing

Text books:				
1	Remote Sensing: Models and Methods for Image Processing	Third Edition,2007	Robert Schowengerdt A.	Elsevier
2	Remote Sensing Digital Image Analysis	4th Edition, 2006	John A. Richards, Xiuping Jia	Springer

Reference books:				
1	Introductory Digital Image Processing: A Remote Sensing Perspective	Fourth Edition, 2016	Jhon R. Jensen	Pearson Series
2	Physical Principles of Remote Sensing	Third Edition, 2012	W.G. Rees	Cambridge UniversityPress