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 Engineering
SoE & Syllabus 2018
3rd To 8th Semester
Electronics & Telecommunication Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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

SoE No. ET-201

B.E. SCHEME OF EXAMINATION 2018-19

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electronics & Telecommunication 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	30	40	3 Hours
2	3	PC	ET2201	Electronic Devices and Circuits	**T**	3	1	0	4	4	30	30	40	3 Hours
3	3	PC	ET2202	Lab: Electronic Devices and Circuits	**P**	0	0	2	2	1		60	40	
4	3	PC	ET2203	Digital Circuits and Fundamentals of Microprocessor.	**T**	3	0	0	3	3	30	30	40	3 Hours
5	3	PC	ET2204	**Lab:** Digital Circuits and Fundamentals of Microprocessor.	**P**	0	0	2	2	1		60	40	
6	3	PC	ET2205	Electronic Measurement and Instrumentation	**T**	3	0	0	3	3	30	30	40	3 Hours
7	3	PC	ET2206	Lab: Electronic Measurement and Instrumentation	**P**	0	0	2	2	1		60	40	
8	3	PC	ET2207	Network Analysis	**T**	3	0	0	3	3	30	30	40	3 Hours
				TOTAL THIRD SEM		**15**	**1**	**6**	**22**	**19**				

Fourth Semster														
1	4	BS	GE2204	Advance Mathematical Techniques	**T**	3	0	0	3	3	30	30	40	3 Hours
2	4	PC	ET2251	Electromagnetic Fields	**T**	3	1	0	4	4	30	30	40	3 Hours
3	4	PC	ET2252	Microcontroller and Interfacing	**T**	3	0	0	3	3	30	30	40	3 Hours
4	4	PC	ET2253	Lab: Microcontroller and Interfacing	**P**	0	0	2	2	1		60	40	
5	4	PC	ET2254	Analog Communication	**T**	3	0	0	3	3	30	30	40	3 Hours
6	4	PC	ET2255	Lab: Analog Communication	**P**	0	0	2	2	1		60	40	
7	4	PC	ET2256	Control Systems	**T**	3	0	0	3	3	30	30	40	3 Hours
8	4	PC	ET2257	Lab.: Control Systems	**P**	0	0	2	2	1		60	40	
				TOTAL FOURTH SEM		**15**	**1**	**6**	**22**	**19**				

List of Audit Courses														
1	3	HS	GE2121	Env Studies for 3 Sem. EL,ET,CT	**A**	3	0	0	3	0				

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

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

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

		June 2020	1.02
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2020-21 Onwards

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Electronics & Telecommunication 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	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	30	40	3 Hours
2	5	PC	ET2301	Analog Integrated circuits	**T**	3	0	0	3	3	30	30	40	3 Hours
3	5	PC	ET2302	Lab: Analog Integrated circuits	**P**	0	0	2	2	1		60	40	
4	5	PC	ET2303	Fields & Radiating Systems	**T**	3	1	0	4	4	30	30	40	3 Hours
5	5	PC	ET2304	Signals & Systems	**T**	3	0	0	3	3	30	30	40	3 Hours
6	5	PC	ET2305	Lab. :Signals & Systems	**P**	0	0	2	2	1		60	40	
7	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	30	40	3 Hours
8	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	30	40	3 Hours
9	5		ET2306	Lab.: Electronics Workshop	**P**	0	0	2	2	1		60	40	
10	**5/6**	**STR**	**ET2310**	**Industry Visit and its report**	**P**	0	0	0	0	1		100		
				TOTAL FIFTH SEM		**18**	**1**	**6**	**25**	**23**				

Audit Courses											
1	5	IT	IT1121	Industrial Programmin Language	**A**	3	0	0	3	0	

Open Electives -I

1	5	OE 1	ET2311	OE I : Microcontroller & Embedded Systems
2	5	OE 1	ET2312	OE I : Principles of Communication Engineering
3	5	OE 1	ET2313	OE I : Fundamentals of Image Processing

Open Electives -II

4	5	OE 2	ET2321	OE II : Soft computing
5	5	OE 2	ET2322	OE II : Industrial Instrumentation
6	5	OE 2	ET2323	OE II : Medical Electronics
7	5	OE 2	ET2324	OE II : Display Technology & Applications
7	5	OE 2	ET2325	OE II : PLCs and SCADA

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Electronics & Telecommunication 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	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	30	40	3 Hours
2	6	PC	ET2351	Digital Signal Processing	**T**	3	0	0	3	3	30	30	40	3 Hours
3	6	PC	ET2352	Lab: Digital Signal Processing	**P**	0	0	2	2	1		60	40	
4	6	PE		Professional Elective I	**T**	3	0	0	3	3	30	30	40	3 Hours
5	6	PE		Lab. : Professional Elective I	**P**	0	0	2	2	1		60	40	
6	6	PE		Professional Elective II	**T**	3	0	0	3	3	30	30	40	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	30	40	3 Hours
9	6	OE		Open Elective - IV **	**T**	3	0	0	3	3	30	30	40	3 Hours
				TOTAL SIXTH SEM		**18**	**0**	**6**	**24**	**21**				

Professional Electives -I

1	6	PE I	ET2361	PE I : Object Oriented Programming
2	6	PE I	ET2362	PE I : Lab. Object Oriented Programming
3	6	PE I	ET2363	PE I : Discrete Structures
4	6	PE I	ET2364	PE I : Lab. Discrete Structures
5	6	PE I	ET2365	PE I : Microprocessors and Peripherals
6	6	PE I	ET2366	PE I : Lab. Microprocessors and Peripherals
7	6	PE I	ET2367	PE I : Electronic Instrumentation
8	6	PE I	ET2368	PE I :Lab Electronic Instrumentation
9	6	PE I	ET2371	PE I : Fundamentals of Computing
10	6	PE I	ET2372	PE I : Lab Fundamentals of Computing
11	6	PE I	ET2373	PE I : Algorithms and data structures
12	6	PE I	ET2374	PE I :Lab Algorithms and data structures

Professional Electives -II

1	6	PE II	ET2377	PE II : Antenna Theory & Design
2	6	PE II	ET2378	PE II : Lab. Antenna Theory & Design
3	6	PE II	ET2379	PE II : Digital system Design
4	6	PE II	ET2380	PE II : Lab. Digital system Design
5	6	PE II	ET2381	PE II : Internet of Things (IoT)
6	6	PE II	ET2382	PE II : Lab. Internet of Things (IoT)
7	6	PE II	ET2383	PE II : Optical Communication
8	6	PE II	ET2384	PE II : Lab. Optical Communication
9	6	PE II	ET2385	PE II :Principles of image processing
10	6	PE II	ET2386	PE II : Lab. Principles of image processing
11	6	PE II	ET2387	PE II : TV & Video Engineering
12	6	PE II	ET2388	PE II : Lab. TV & Video Engineering

Open Electives -III

1	6	OE 3	ET2391	OE III : Microcontroller & Embedded Systems
2	6	OE 3	ET2392	OE III : Principles of Communication Engineering
3	6	OE 3	ET2393	OE III : Fundamentals of Image Processing

Open Electives -IV

4	6	OE 4	ET2396	OE IV : Soft computing
5	6	OE 4	ET2397	OE IV : Industrial Instrumentation
6	6	OE 4	ET2398	OE IV : Medical Electronics
7	6	OE 4	ET2399	OE IV : Display Technology & Applications
7	6	OE 4	ET2400	OE IV : PLCs & SCADA

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		June 2020	1.02
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2020-21 Onwards

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SoE No. ET-201.1

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

Electronics & Telecommunication 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	ET2401	RF & Microwave	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	ET2402	Lab: RF & Microwave	**P**	0	0	2	2	1		60	40	
3	7	PC	ET2403	Digital Communication	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PC	ET2404	Lab: Digital Communication	**P**	0	0	2	2	1		60	40	
5	7	PE		Professional Elective III	**T**	3	0	0	3	3	30	20	50	3 Hours
6	7	PE		Professional Elective IV	**T**	3	0	0	3	3	30	20	50	3 Hours
7	7	PE		Professional Elective V	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	PE		Professional Elective VI	**T**	3	0	0	3	3	30	20	50	3 Hours
9	7	STR	ET2409	Mini Project	**P**	0	0	4	4	2		60	40	
10	7	STR	ET2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
				TOTAL SEVENTH SEM		**18**	**0**	**8**	**26**	**24**				

Professional Electives -III

1	7	PE	ET2411	PE III : Power Electronics
2	7	PE	ET2412	PE III : Data Compression & Encryption
3	7	PE	ET2413	PE III : Analog VLSI
4	7	PE	ET2414	PE III : Error Correcting Codes
5	7	PE	ET2415	PE III : Wireless Mobile Communication Systems

Professional Electives -IV

6	7	PE	ET2421	PE IV : Satellite Communication & RADAR Engineering
7	7	PE	ET2422	PE IV : Embedded System
8	7	PE	ET2423	PE IV : Switching Theory
9	7	PE	ET2424	PE IV : Topics in Machine Learning
10	7	PE	ET2425	PE IV : Multimedia Communications

Professional Electives -V

11	7	PE	ET2431	PE V : Display Technology
12	7	PE	ET2432	PE V : Biomedical Instrumentation
13	7	PE	ET2433	PE V : Fuzzy Logic & Neural Network
14	7	PE	ET2434	PE V : Wireless Sensor Networks
15	7	PE	ET2435	PE V : RF Circuit Design

Professional Electives -VI

16	7	PE	ET2441	PE VI : CMOS VLSI Design
17	7	PE	ET2442	PE VI : Digital Image Analysis for Remote Sensing
18	7	PE	ET2443	PE VI : Microwave Integrated circuits
19	7	PE	ET2444	PE VI : Communication Networks
20	7	PE	ET2445	PE VI : Computer Architecture and Organization
20	7	PE	ET2446	PE VI : PLCs & SCADA

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		June 2022	1.06	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

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Electronics & Telecommunication 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	ET2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	ET2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				

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

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

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

		June 2022	**1.06**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

III Semester
GE2201 - Engineering Mathematics-III

Course Objective Students should be able to	Course Outcomes Students will be able to
1. To find numerical solution of various mathematical equations 2. To introduce concept of Laplace transform, Z transform, Fourier transform 3. To express the periodic functions in the form of Fourier series 4. To solve partial differential equations	1. Estimate the Calculus of Numerical Function. 2. Determine the 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-1: : Finite Differences **[8 hrs]**
Difference table; Operators E and Δ, Central differences, Factorials notation Numerical differentiation and integration, Difference equations with constant coefficients.

UNIT- 2 : Laplace Transform **[7 hrs]**
Laplace Transforms: Laplace transforms and their simple properties(with proof), Unit step function Heaviside unit step function and inverse, convolution theorem, , Applications of Laplace transform to solve ordinary differential equations including simultaneous equations.

UNIT-3 : Z-transform **[8 hrs]**
Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and redidue theorem, , Applications of Z-transform to solve difference equations with constant co-efficient.

UNIT-4 : Matrices **[9 hrs]**
Inverse of matrix by adjoint method and its use in solving simultaneous equations, rank of a matrix (by partitioning method) consistency of system of equation, Inverse of matrix by partitioning method Linear dependence, Linear and orthogonal transformations. Characteristics equations, eigen values and eigen vectors. Reduction to diagonal form, Cayley Hamilton Theorem (without proof) statement and verification, Sylvester"s theorem, Association of matrices with linear differential equation of second order with constant coefficient.

UNIT-5 : Fourier Series and Partial Differential Equation **[8 hrs]**
Fourier Series – Periodic Function and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions.
Partial Differential Equations – PDE 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 forst and second order partial differential equations.

UNIT-6 : Fourier Transform **[6 hrs]**
Definition : Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval"s Identity, convolution Theorem.

Text Books:

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

Reference Books:

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

III Semester
ET2201 - Electronic Devices and Circuits

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1) Understand working principle of semiconductor Device and Learn the operation of the BJT. 2) Learn transistor biasing and stabilization techniques and the Understand the operation and characteristics of Field effect transistor. 3) Study low and high frequency analysis of transistors 4) Understand the characteristics of various electronic devices	1) Apply the knowledge of semiconductor diodes in circuit analysis 2) Analyze the transistor circuits for different configurations. 3) Design transistor circuit with suitable biasing and stabilization techniques. 4) Analyze the response of transistors at low and high frequency 5) Analyze power amplifier circuits.

Unit - I **7Hrs**

Semiconductor Diodes: PN junction diode and its application, Physics and structure of diodes, Diode small signal model, Zener diode, Rectifier circuits, Clipping and clamping circuits. Rectifier circuits, Zener shunt regulator.

Unit – II **7Hrs**

Bipolar Junction Transistors : Physical structure and operation modes, Active region operation of transistor, DC analysis of transistor circuits, Ebor-Moll model ,Current voltage characteristics of CE, CB, CC configuration Transistor as an amplifier, Biasing the BJT, Transistor as a switch.

Unit – III **6Hrs**

Transistor Biasing, The Operating Point, Bias Stability, Self-Bias, Fixed bias, collector to base bias, Emitter feedback bias, Stabilization against Variations in Ico, VBE, AND β, Collector-Current Stability, Thermal Runaway.

Unit – IV **7Hrs**

Field-effect Transistors -The Junction Field-effect Transistor, The Pinch-off Voltage Vp, The JFET Volt-Ampere Characteristics, MOSFET Device Structure and Physical Operation of MOSFET, Finite Output Resistance in Saturation, Characteristics of the MOSFET, Small Signal Equivalent Model, MOSFET Biasing by Fixing VGS, Biasing by Fixing VG and Connecting a Resistance in the Source, Biasing Using a Drain-to-Gate Feedback Resistor, Biasing Using a Constant-Current Source.

Unit – V **7Hrs**

Small signal operation of BJT, small signal operation of MOSFET using π model and T model, Internal capacitances and high frequency model of BJT and MOSFET.

Unit – VI **6Hrs**

Power Amplifier : Class A, Class B, Class AB and Class C, Power Efficiency, Power Dissipation, Cross-Over Distortion in Class AB Circuits, Class A Transformer Coupled Power Amplifier, Harmonic Distortion due to Large Signal operation

Text Books:

SN	Title	Authors	Edition	Publisher
1	Microelectronics Circuits	Sedra Smith	5th Edition 2010-01-07	Oxford Uni. Press
2	Integrated Electronics	MillMan Halkias	7th edition 2009	Tata McGraw Hills

Reference Books:

SN	Title	Authors	Edition	Publisher
1	Electronic Devices and Theory	BoyleStad, Nashelsky	9th. Edition May 2010	PHI
2	Electronic Devices and Circuits	S Salivahanan, N Suresh Kumar	3rd Edition	Tata McGraw Hills

III Semester
ET2202 - Lab: Electronic Devices and Circuits

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1) Understand working principle of semiconductor Device and Learn the operation of the BJT. 2) Learn transistor biasing and stabilization techniques and the Understand the operation and characteristics of Field effect transistor. 3) Study low and high frequency analysis of transistors 4) Understand the characteristics of various electronic devices	1) Apply the knowledge of semiconductor diodes in circuit analysis 2) Analyze the transistor circuits for different configurations. 3) Design transistor circuit with suitable biasing and stabilization techniques. 4) Analyze the response of transistors at low and high frequency 5) Analyze power amplifier circuits.

Expt. No.	Name of Experiment
1	To plot the V- I characteristics of PN junction diode (Silicon), Zener diode, LED.
2	To find the i) Voltage regulation ii) Load Regulation of a Zener shunt regulator
3	To Design Clipping and Clamping circuits.
4	To Design Half wave & Full Wave Rectifier with filter
5	To plot I/P & O/P Characteristics of Common Base Transistor
6	To plot I/P & O/P Characteristics of Common Emitter Transistor Configuration
7	To obtain Frequency Response of single stage CE Amplifier
8	To plot Drain and Transfer characteristics of Field Effect Transistor (FET)
9	To plot Drain and Transfer characteristics of Metal Oxide Semiconductor Field Effect Transistor (MOSFET)
10	To plot the frequency response of Common Source amplifier.
11	To Design Fixed Bias circuit and Self Bias circuit and observe the effect of temperature variation on transistor parameters
12	To Design Class B Amplifier with Cross Over Distortion .
13	Orcad based simulation of class AB power Amplifier.

III Semester
ET2203 - Digital Circuits and Fundamentals of Microprocessor

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Learn digital logic families and minimization method. 2. Understand the concept of Combinational circuits using MSI and LSI chips 3. Learn arithmetic circuits 4. Know Synchronous, and Asynchronous counters and flip flops 5. Study 8085 Microprocessor. 6. Study assembly language programming.	1. Illustrate logic families, BCD arithmetic. 2. Simplify the logic functions using various minimization techniques. 3. Design Combinational and sequential logic circuits. 4. Explain the architecture and instructions of 8085 5. Develop 8085 microprocessor programs

Unit - I **[6 Hrs]**

Introduction to Logic families & their characteristics. Fan-In, Fan-out, Propagation delay, Power dissipation, Noise Margin, CMOS inverter. BCD arithmetic, simplification of Boolean expressions, Implementations of Boolean expressions using logic gates, Karnaugh map, Quine Mcclauskey methods ,Formation of switching functions from word statements.

Unit - II **[5 Hrs]**

Functions & implementation using Multiplexer, Demultiplexer, Encoder, Decoder. Combinational circuit analysis, Combinational circuits design using MSI and LSI chips, Code Converters.

Unit - III **[5 Hrs]**

Design of Arithmetic circuits: Half & Full adders, Half & Full subtractors , Multibit parallel adders, Carry Propagate adder & Carry Look ahead adder, BCD Adder, Comparators, Multi bit Application designs, ALU

Unit - IV **[6 Hrs]**

Edge & Level triggers. Need for sequential circuits, Binary cell, Latches and flip-flops. RS-FF, D-FF, JK-FF, Master-Slave JK-FF & T-FF, Excitation & Truth Table, Flip-flop conversions, Shift registers, Synchronous and Asynchronous sequential Circuits. Counters Design, Ring counter.

Unit - V **[7 Hrs]**

Introduction to 8085 Microprocessor-Architecture, Addressing Modes, Instruction set, PIN configuration

Unit - VI **[7 Hrs]**

8085 Advanced instructions, Assembly language programming, Interrupts.

Text books:

SN	Title	Authors	Edition	Publisher
1	Digital Design	Morris Mano	3rd edition	Pearson PH
2	Microprocessor Architecture, Programming and Applications with the 8085	Ramesh Gaonkar	-	Penram International Publications

Reference books:

SN	Title	Authors	Edition	Publisher
1	Digital Circuits & Microprocessors	Hebert Taub	5th edition	Mc Graw Hill
2	Fundamentals of Digital Logic with VHDL Design	Stephen Brown & Zvonko Vranesic	2nd Edition	TMH
3	Engg Approach to Digital Design	W. Fletcher	1st edition	PHI

III Semester
ET2204 - Lab: Digital Circuits and Fundamentals of Microprocessor

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Learn digital logic families and minimization method. 2. Understand the concept of Combinational circuits using MSI and LSI chips 3. Learn arithmetic circuits 4. Know Synchronous, and Asynchronous counters and flip flops 5. Study 8085 Microprocessor. 6. Study assembly language programming.	1. Illustrate logic families , BCD arithmetic. 2. Simplify the logic functions using various minimization techniques. 3. Design Combinational and sequential logic circuits. 4. Explain the architecture and instructions of 8085 5. Develop 8085 microprocessor programs

Expt. No.	Name of Experiment
1	Design and Realize basic logic gates using Universal gates
2	Design of Adder
3	Design of Subtractor
4	Design of combinational logic circuits
5	Design of code converters
6	Design of Multiplexer
7	Design of Comparator
8	Design of Decoder
9	Implementation of flip flop
10	Design of Shift Resister
11	Design of Mod-N Up-Down Counter
12	Design of synchronous counter
13	Design of Asynchronous counter
14	Develop the programme using 8085Microprocessor
15	Mini Project

III Semester
ET2205 - Electronic Measurement & Instrumentation

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Understand basic measurement system with different types of standards and errors 2. Understand working of A.C. & D.C. bridges 3. Study different types of meters, display devices, generators ,analyzers ,sensor and transducers 4. Understand the concept of data conditioning system	1. Elaborate basic measurement and instrumentation system 2. Analyze the types of errors, bridge circuits and gauge factor of strain gauges 3. Explain the working of display devices, generators, and analyzers 4. Measure different physical parameters using suitable transducers

Unit - I **5Hrs**

Introduction, standards, Static & dynamic characteristics of measurement system, need of calibration, Types of errors & their sources, limiting errors & Statistical analysis

Unit – II **6Hrs**

AC & DC Bridges DC bridges - Wheatstone bridge, sensitivity of Wheatstone bridge, Kelvin's bridge.
AC bridges – Inductance measurement- Maxwell's Induction bridge, Maxwell's Induction capacitance bridge, Hays Bridge, Capacitance measurement- Schering bridge, Frequency measurement- Wien bridge.

Unit – III **6Hrs**

Amplified DC meters, AC Voltmeter, TRUE/RMS voltmeter, Electronic Multimeter, Digital Multimeter, Digital Voltmeter, Q-meter, LCR meter, dual trace CRO, Dual beam CRO, Digital Storage Oscilloscope, Introduction to instrumentation buses.

Unit – IV **6Hrs**

AF Generator, Pulse characteristics, Pulse Generators, Function Generator, Sweep Frequency Generator, Wave analyzer, Spectrum analyzer, Distortion analyzer.

Unit – V **7Hrs**

Definition, Classification of transducer, Selection of Transducer, Resistive transducer- Potentiometer, RTD, Thermistor, LM35 temperature sensor, Strain Gauges, strain gauge Load Cells, Inductive transducer- LVDT, capacitive transducers- Variable area, variable distance, Piezoelectric Transducer, thermoelectric (Thermocouple), photoelectric transducers, Digital optical encoder, Light sensor, Electromagnetic flow meter, Ultrasonic sensors, Hall Effect Sensor.

Unit – VI **6Hrs**

Signal conditioning and its necessity, Functions of Signal conditioning, AC/DC Conditioning systems, Instrumentation Amplifier, Data conversion: ADC & its types, DAC, Generalized data acquisition system: single channel, multi-channel and modular DAS.

Text books:

SN	Title	Authors	Edition	Publisher
1	Modern Electronic Instrumentation and Measurement Techniques	Albert D. Helfrick William D. Cooper	2007 Edition	PHI
2	Electrical and electronics Measurement and Instrumentation	A. K. Sawhney	4th Edition	Dhanpat Rai& Co

Reference books:

SN	Title	Authors	Edition	Publisher
1	Elements of Electronic Instrumentation and Measurement	Joseph J. Carr	3rd edition	Pearson Education
2	Electrical and electronic Measurement	R. K. Rajput	1st Edition	PHI Publication
3	Transducers &Inst	DVS Murthy	2nd Edition	PHI Publication

		June 2019	1.00	Applicable for AY 2021-22 Onwards
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III Semester
ET2206 - Lab: Electronic Measurement & Instrumentation

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Understand basic measurement system with different types of standards and errors 2. Understand working of A.C. & D.C. bridges 3. Study different types of meters, display devices, generators ,analyzers ,sensor and transducers 4. Understand the concept of data conditioning system	1. Elaborate basic measurement and instrumentation system 2. Analyze the types of errors, bridge circuits and gauge factor of strain gauges 3. Explain the working of display devices, generators, and analyzers 4. Measure different physical parameters using suitable transducers

Expt. No.	Name of Experiment
1	Measure the value of unknown Resistance by using Wheatstone Bridge.
2	Measure the value of unknown Resistance by using Kelvin's Bridge.
3	Measure the value of unknown Inductance by using Maxwell's Inductance-Capacitance Bridge.
4	Measure the value of unknown Inductance by using Hay's Bridge.
5	Measure unknown capacitance using Shearing Bridge.
6	Measure unknown capacitance or frequency using Wien Bridge.
7	Measure unknown values of L,C,R using LCR-Q meter
8	Measure the unknown temperature & Plot Temperature Vs Resistance characteristics using RTD.
9	Plot the V-I characteristics of RTD
10	Measurement of Temperature using Thermocouple.
11	Measure the linear displacement using LVDT.
12	Plot the input output characteristics of LVDT
13	Measurement of Pressure using Bourdon tube.
14	Measurement of Strain using Strain Gauge or load cell.
15	Identify the additional functions of Dual trace CRO.
16	Measurement of various parameters using DSO
17	To Study concept behind Grounding and Shielding
18	Measurement of component values using Virtual DMM Instrumentation(beyond syllabus)
19	Generation & Measurement of voltage and Frequency using Virtual function generator and CRO (beyond syllabus)
20	Transient analysis using DSO
21	Study characteristic of Photo conductive cell
22	Measurement of Humidity using Humidity sensor
23	Speed measurement of DC motor using proximity speed sensor

III Semester
ET2207 - Network Analysis

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1) The fundamental principles of electrical circuit analysis using mesh - node method for problem solving in mathematics, science, and engineering 2) To appreciate the consequences of linearity using various network theorems. 3) To analyze analog circuits that include energy storage elements using Laplace transforms for circuit analysis. 4) To analyze and synthesize waveforms for different electrical parameters. 5) To analyze four terminal networks using two-port parameters	1) Analyze electrical circuits using nodal and mesh analysis 2) Evaluate electrical circuit parameters using network theorems 3) Estimate steady state and transient response of electrical circuits using initial and final conditions 4) Analyze waveforms using Laplace transform 5) Evaluate parameters of two – port networks.

UNIT-I: Nodal Analysis of Electric Circuits [6 Hrs]

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 , nodal analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy. Series Circuit, Parallel Circuit, Source shifting, Principe of duality, concept of V-shift and I-shift.

UNIT-II:: Mesh Analysis of Electric Circuits [6 Hrs]

Mutual inductance, coefficient of coupling, dot convention, dot marking in coupled coils, meshanalysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-III :Network Theorem [6 Hrs]

Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem.

UNIT-IV: Initial and Final Conditions, Impedance Functions and Circuit Analysis with Laplace Transform [6 Hrs]

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, Transient analysis.

UNIT-V : Transforms of other Signal Waveforms, Network Functions, Poles and Zeros of network functions [6 Hrs]

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 8ascade8r from the pole – zero plot, network synthesis using pole – zero plot.

UNIT-VI: Two Port Parameters [6 Hrs]

Standard reference directions for the voltages and currents of a two – port network, defining equations for open circuit impedance, short circuit admittance, transmission, inverse transmission, hybrid and inverse hybrid parameters, relationships between parameter sets, interconnections of two – port networks. Transistor as a two port network.

Text books:				
1	Network Analysis	3rd Edition	M. E. Van Valkenburg	PHI Learning Private Limited
2	Engineering Circuit Analysis	8th Edition	William H. Hayt, Jack E. Kemmerly, Steven M. Durbin	McGraw – Hill
3	Linear Circuit Analysis	2nd Edition	Decarlo, Lin	Oxford Univ. Press

Reference books:				
1	Schaum's 3000 Solved Problems In Electric Circuits Book 1 & 2	1st Edition	Syed A. Nasar	McGraw – Hill
2	Basic Circuit Theory	3rd Edition	Lawrence P. Huelsman	PHI Learning Private Limited
3	Problems and Solutions in Network Analysis		R. Gopal	CBS

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IV Semester
GE2204 - Advanced Mathematical Techniques

Course Objectives Students should be able to	Course Outcomes Students will be able to
1. To introduce various Numerical Methods to solve algebraic and differential equations 2. To understand the concept of Probability distribution 3. To introduce the concept of Fuzzy Set theory and functions 4. To make aware of different optimization techniques	1. Utilize numerical techniques to obtain approximate solutions of mathematical equations 2. Measure the Statistical parameters for random variables 3. Explain the basic concept of fuzzy sets, Relations and fuzzy logic. 4. Design and determine the solution of linear programming problems

UNIT-1: **[9 hrs]**

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 Rapphson method and their convergence NUMERICAL METHODS SYSTEM OF ALGEBRAIC EQUATIONS: Solution of System of linear equation, Gauss elimination method, Gauss -Jordan method, Gauss- Seidel method, Crouts method & relaxation method.

UNIT-2: **[8 hrs]**

NUMERICAL METHODS FOR DIFFERENIAL EQUATIONS: Numerical solution of ordinary differential equation by Taylor"s series method, Picard's method, Runge"s second and third order method, Runge-Kutta 4th order method, Euler"s method, Euler"s modified method, Milne"s Predictor and Corrector method. Numerical methods of solving 1st order simultaneous ordinary differentials equations

UNIT-3 : Optimization Techniques **[6 hrs]**

Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method,

UNIT-4 **[7 hrs]**

Random variable and probability distribution: Random variable: discrete and continuous; probability density function; Probability distribution function for discrete, and continuous random variable Joint distributions, conditional distributions.

UNIT-5: **[8 hrs]**

Mathematical Expectation: Definition of mathematical expectation, functions of random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.

UNIT-6 **[6 hrs]**

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.

IV Semester
GE2204 - Advanced Mathematical Techniques

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

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

IV Semester
ET2251 - Electromagnetic Fields

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Learn different types of co-ordinate systems 2. Understand different laws applicable for electric field and magnetic field. 3. Understand Maxwell's equations in static and time varying fields 4. Study different principles of wave propagation theory.	1. Use appropriate co-ordinate systems for solving electromagnetic fields problems 2. Apply the principles of electrostatics & magneto-statics for the solution of problems relating to electric and magnetic field 3. Analyze static and time varying fields using Maxwell's equations 4. Examine wave propagation in different medium.

UNIT-1: **6 Hrs**

Orthogonal coordinate systems: Cartesian, cylindrical, spherical and transformations, Gradient of a Scalar Field . Divergence of a Vector Field , Curl of a Vector Field , Laplacian Operator, Irrotational and solenoidal field .

UNIT-2: **7 Hrs**

Coulomb's law , Electric field intensity for different charge distribution : point , line surface , volume , Concept of electric flux , Gauss's law and it's application to field computation in symmetric structures and non symmetric structures , Divergence theorem.

UNIT-3: **7 Hrs**

Concept of energy & work done in moving a point charge : linear and circular path , Electric scalar potential :Absolute Potential and potential difference , Conservative property of Potential field , Potential field of a system of charges : circular ring and disk Dipole moment, electric field at a distant point due to electric dipole, Electrostatic energy density. Poisson's and Laplace's equation and its examples of solutions, Uniqueness of electrostatic solution

UNIT-4: **6 Hrs**

Biot –Savart law and applications to infinite and finite current filament, Ampere's Circuital law and applications to line charge, coaxial transmission cables, uniform current sheet charge, solenoid, toroid , Stoke's Theorem Magnetic flux and magnetic flux density , Scalar and vector magnetic potential, Nature of magnetic materials , boundary conditions at interface of two magnetic fields , Potential energy.

UNIT-5: **6 Hrs**

Time varying fields and Maxwell's equations: Faradays law, Displacement current, Maxwells equation in point form,Maxwells equations in integral form.

UNIT-6: **6 Hrs**

Uniform plane wave, wave propagation in free space, wave propagation in Dielectrics,Poyntings Theorem and wave equations.

Text books:

1	Engineering Electromagnetics	Seventh Edition	William H. Hayt	Tata McGraw – Hill.
2	Electromagnetics	4th edition1992	J D Kraus	McGraw – Hill
3	Field and Wave Electromagnetics	Second Edition 21 Jan 2010	David K. Cheng	Addison Wesley

Reference books:

1	Electromagetism Theory and application	2nd Edition2009	Ashutosh Pramanik	Prentice Hall
2	Elements of Electromagnetis		M. N. O. Sadku	Oxford Press

IV Semester
ET2252 - Microcontroller and Interfacing

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Understand the architecture and pin functions of 8 bit microcontroller. 2. Study the assembly language instruction set. 3. Understand programming microcontroller in C language. 4. Understand interfacing of on and off chip peripherals with 8051 microcontrollers.	1. Elaborate 8051 microcontroller architecture. 2. Develop assembly language programs. 3. Develop embedded C language program. 4. Interface peripherals with 8051 microcontroller to solve real life problems.

UNIT-1: **5 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.

UNIT-2: **6 Hrs**
Addressing modes, Instruction set and Assembly language programming Programs using look up table, Bit manipulation, 8051 I/O programming, Delay Programs.

UNIT-3: **6 Hrs**
I/O Interfacing such as LED, switches, 7segment display, keyboard matrix programming, 8051 programming in C: Data types and time delay, I/O programming, Logic operations, Data conversion programs, Lookup table access.

UNIT-4: **8 Hrs**
Timer programming in assembly and C: Various modes of operation, SFR related to timer operation. Serial Port programming in assembly and C: Basics of serial communication, 8051 connection to RS 232. Serial data transfer programs..

UNIT-5: **6 Hrs**
8051 interrupts, Interrupts programming in assembly and C, programming timer interrupt, external interrupt, serial interrupt Interfacing and programming for LCD, Interfacing RTC

UNIT-6: **7 Hrs**
Interfacing of ADC, DAC, stepper motor, Brushless DC motors, interfacing of peripherals 8255, 8259.

Resources :

Text books:

1	The 8051 Microcontroller and Embedded systems using assembly & C	2nd edition	Muhammad Ali Mazidi	Pearson Education Asia LPE
2	Programming and Customizing the 8051 Microcontroller		Myke Predko	McGraw-Hill
3	The 8051 Microcontroller	3rd edition	Kenneth Ayala	CENGAGE Learning

Reference books:

1	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets	Douglas V Hall	Tata McGraw Hill
2	Microprocessor & Interfacing	A. K. Ray, K. M. Bhurchandi.	Tata McGraw Hill

IV Semester
ET2253 - Lab: Microcontroller and Interfacing

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Understand the architecture and pin functions of 8 bit microcontroller. 2. Study the assembly language instruction set. 3. Understand programming microcontroller in C language. 4. Understand interfacing of on and off chip peripherals with 8051 microcontrollers..	1. Explain 8051 microcontroller architecture. 2. Develop assembly language program. 3. Develop embedded C language program. 4. Interface 8051 microcontroller to solve real life problems.

Expt. No.	Name of Experiment
1	Add data bytes in a internal RAM
2	Data block transfer
3	Find the maximum data byte in a block
4	Count even numbers present in a data block
5	Convert packed BCD number to its equivalent Hexadecimal number
6	To find average of numbers
7	Toggle LED connected to port pin of micro-controller 8051
8	Display BCD no. on seven segment display
9	Display character on LCD.
10	Rotate stepper motor into clockwise /counter clockwise direction
11	Generate sawtooth waveform using DAC
12	Send string of characters serially
13	Toggle LED connected to port P0.4 of microcontroller 8051.Genrate time delay using internal timer.
14	Read Analog signal from channel 2 of ADC and store it to internal RAM
15	Interfacing of RTC DS12887 with 8051 microcontroller & display current date & time serially
16	Interfacing of matrix keyboard with 8051 microcontroller
17	Interfacing of servo motor with 8051
18	Programming external interrupt using 8051 microcontroller
19	Program to count number of pulses using timer as event counter
20	**Mini-project**

IV Semester
ET2254 - Analog Communication

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Understand the fundamental s of amplitude and angle modulation schemes. 2. Learn AM and FM receivers 3. Know the fundamentals of TV transmission and reception techniques. 4. Study the concept of Pulse modulation techniques, noise and wave propagation	1. Analyze different modulation techniques 2. Analyze different parameters of communication receivers. 3. Elaborate the concept of television transmission and reception 4. Estimate noise in communication system 5. Select appropriate techniques for wave propagation of signals.

UNIT-1: **[06hrs]**
Amplitude Modulation: Need for modulation, Amplitude Modulation (AM), DSB-SC, SSB, VSB transmissions, mathematical Analysis, modulation index, frequency spectrum, power requirement of these Systems, AM Transmitter.

UNIT-2: **[06hrs]**
Angle Modulation: Frequency Modulation (FM), mathematical Analysis, modulation index, frequency spectrum, narrowband & wideband FM, noise triangle in FM, pre-emphasis & de-emphasis techniques, phase modulation, power contents of the carrier & the sidebands in angle modulation, FM Transmitter block diagram.

UNIT-3: **[06hrs]**
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.

UNIT-4: **[06hrs]**
TV Fundamentals, Color Composite Video Signal, Horizontal sync and blanking pulses, Vertical sync and blanking pulses, color burst signal, Interlaced and Sequential scanning, Resolutions, CCIR-B Standards, TV Transmitter and Receiver Block diagram.
HDTV introduction and definition, digital satellite television, digital TV receiver, Merits of digital TV receiver

UNIT-5: **[06hrs]**
Noise: Sources of noise, shot noise, thermal noise, noise calculations, equivalent noise bandwidth, noise figure of an amplifier, effective noise temperature, calculation of noise figure for cascaded stages.

UNIT-6: **[06hrs]**
Pulse Modulation Techniques: Generation and Demodulation of PAM, PWM, PPM.
Radiation & Propagation of signals: Basics of Radiation, Mechanisms of propagation, Ground wave, space wave and sky wave propagation, duct propagation, troposphere propagation, fading, diversity reception.

Text books:

1	Electronic Communication System	4thEdition-(Year: 1999)	Gorge Kennedy	Tata McGraw-Hill.
2	Digital and analog communication systems	1stedition 1979	K. Sam Shanmugam	John Wiley & Sons
3	Modern Television Practice	3rdEdition 2006	R.R.Gulati	New Age International publishers.

Reference books:

1	Electronic Communication Systems	Third Edition 1998	Frank R. Dungan	Delmar Publishers
2	Communication Electronics	Third Edition 2001	Frenzel	MGH.
3	Television and Video Engineering	2ndEdition MAY 2001	Dhake.A.M	Tata McGraw Hill

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IV Semester
ET2255 - Lab: Analog Communication

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Understand the fundamental s of amplitude and angle modulation schemes. 2. Learn AM and FM receivers 3. Know the fundamentals of TV transmission and reception techniques. 4. Study the concept of Pulse modulation techniques, noise and wave propagation	1. Analyze different modulation techniques 2. Analyze different parameters of communication receivers. 3. Elaborate the concept of television transmission and reception 4. Estimate noise in communication system 5. Select appropriate techniques for wave propagation of signals.

Expt. No.	Name of Experiment
1	To study the Generation of Amplitude Modulation. Calculate Modulation Index, Bandwidth and plot its frequency spectrum.
2	To study Amplitude Demodulation.
3	To study the Generation of DSB-SC AM using Diode ring modulator. Calculate Bandwidth and plot its frequency spectrum.
4	To study the Generation of Frequency Modulation. Calculate Modulation Index, Bandwidth and plot its frequency spectrum.
5	To study Frequency Demodulation.
6	To study the Phase modulation and Plot the signal waveform.
7	To study Composite Video Signal (CVS) at the output of VIF section.
8	To study Composite Colour Video Signal (CCVS) at the output of VIF section.
9	To study the signal analysis at the different stages of CTV.
10	To study LCD/LED TV receiver and observe the waveform at various test point.
11	To study Time Division Multiplexing (TDM).
12	To study generation of Pulse Amplitude Modulation and Demodulation
13	To study generation of Pulse position Modulation and Demodulation
14	To study generation of Pulse Amplitude Modulation and Demodulation
15	Mini Project

IV Semester
ET2256 - Control Systems

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Apply the knowledge gained in basic mathematics and engineering courses to derive mathematical models 2. Understand different characteristics of negative feedback system and time response of first and second order system also the basic concepts of proportional, integral, and derivative (PID) control. 3. Learn the importance of stability and state space models in control systems and the various methods to determine it. 4. construct root locus plot and frequency response plots such as polar plot, Bode plot etc.	1. Evaluate transfer function of a system 2. Analyze the characteristics of feedback control system 3. Estimate time response of first and second order control systems for different test signals 4. Determine the stability of linear control system 5. Assess frequency domain parameters of linear control system

UNIT-I **[07 hrs]**

Introduction to Control Systems: Basic Components of Control System, Open loop control and close loop control with examples, classification of control systems. Transfer Function, Order of a system, block diagram algebra & reduction techniques, signal flow graph, its constructions and Mason's gain formula.

UNIT-II **[05 hrs]**

Mathematical modelling of physical system such as – electrical, mechanical, electro-mechanical systems.
Characteristics of Feedback Control Systems: Effect of negative feedback compared to open loop system such as – sensitivity to parameter variation, speed of time response, bandwidth, disturbance rejection and linearizing effect, Effect of positive feedback

UNIT-III **[06 hrs]**

Time Domain Analysis of Control Systems: Concept of transient response, Steady state response and time response, standard test signals, system type, dominant poles, steady state error (ess) analysis, static error constants, 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, Relation between roots of characteristic equation, damping ratio and transient response.
Effect of proportional (P), Integral (I) and derivative (D) controllers on the time response concept of transportation lag

UNIT-IV **[07 hrs]**

Concept of stability, stable, unstable, marginally, Absolutely and conditionally stable system, Necessary conditions for stability, method to determine stability, Routh - Hurwitz stability criterion with special cases, relative stability analysis.
State Variable Analysis: Concept of state, state variables and state model, state model of linear systems, state model using physical variables, phase variables and canonical variables, state model from differential equations, block diagramand signal flow graph, transfer function from state model, stability of systems modeled in state variable form, solution of state equations, state transition matrix, its properties and computation.

UNIT-V **[07 hrs]**

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)

IV Semester
ET2256 - Control Systems

UNIT-VI **[07 hrs]**

Frequency domain analysis of control systems: Concept of frequency response and sinusoidal transfer function, resonant frequency, resonant peak, cut off frequency, bandwidth, correlation between time and frequency response, polar plot, inverse polar plot, bode plot, all pass and minimum phase system, experimental determination of transfer function, log magnitude versus phase plot. Stability in Frequency domain: Principle of argument, Nyquist stability criterion, Assessment of relative stability using Nyquist criterion, concept of gain margin and phase margin and its computation using polar plot and log magnitude versus phase plot.

Resources :

Text books:

1	Control system engineering	5th Edition	I. J. Nagrath& M Gopal	New Age International
2	Modern control engineering	5th Edition	Katsuhiko Ogata	PHI Learning
3	Control system engineering	7th Edition	Norman S Nise	Wiley & sons

Reference books:

1	Sigma Series: Control Systems	1st Edition	Ashok Kumar	McGraw - Hill
2	Control systems: Principles and design	4th Edition	M. Gopal	McGraw - Hill
3	Automatic control systems	7th Edition	B. C. Kuo	PHI Learning Private ltd

IV Semester
ET 2257 - Lab: Control Systems

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Apply the knowledge gained in basic mathematics and engineering courses to derive mathematical models 2. Understand different characteristics of negative feedback system and time response of first and second order system also the basic concepts of proportional, integral, and derivative (PID) control. 3. Learn the importance of stability and state space models in control systems and the various methods to determine it. 4. construct root locus plot and frequency response plots such as polar plot, Bode plot etc.	1. Evaluate transfer function of a system 2. Analyze the characteristics of feedback control system 3. Estimate time response of first and second order control systems for different test signals 4. Determine the stability of linear control system 5. Assess frequency domain parameters of linear control system

Expt. No.	Name of Experiment
1	Open loop and closed loop system
2	Effect of feedback on DC Servo system
3	a) Study of ON-OFF controller b) Study of P-I-D controller
4	TYPE 0, TYPE 1, TYPE 2 CONTROL SYSTEM
5	Time Response of a second order system
6	Stability analysis using routh- hurwitz method
7	Root locus from a Transfer function
8	Bode plot from a transfer Function
9	State from zeroes and Poles
10	Transfer function from State model and state model from Transfer function

Nagar Yuwak Shikshan Sanstha's

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

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ELECTRONICS & TELECOMMUNICATION EGNINEERING

V Semester
ET 2301 - ANALOG INTEGRATED CIRCUITS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Design with Operational Amplifiers and Analog Integrated Circuits	2002	Sergio Franco	McGraw-Hill
2	Linear Integrated Circuits	2015	D. Roy Chaudhuri, Shail Jain	New Age International
3	Op-Amps and Linear Integrated Circuits	2015	Ramakant A. Gayakwad	Pearson

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Linear Integrated Circuits	2010	S. Salivahanan, V. S. Bhaaskaran	McGraw-Hill

V Semester
ET 2302 – LAB: ANALOG INTEGRATED CIRCUITS

Course Learning Objectives	Course Outcomes
The student should be able to 1) Understand modern analog circuits using integrated bipolar and field effect transistor technologies. 2) Understand basic principles of analog integrated circuit for analog IC design. 3) Learn operational amplifier basics, its parameters and its applications. 4) Understand Data converters and waveform generators	**The student will be able to** 1) Design and analyze OP-AMP configurations. 2) Analyze OP-AMP circuit parameters and frequency response 3) Design linear and non- linear OP-AMP applications. 4) Explain special function ICs and design circuits using it.

Sr. No.	Name of Experiment
1.	Verify gain and frequency response of Inverting amplifier / Non-inverting amplifier using IC 741 and simulation
2.	Verify Op-amp parameters (a) CMRR (b) Slew Rate
3.	Design and verify op-amp application as adder and subs tractor
4.	Design and simulate gain and frequency response of Integrator and Differentiator circuit Using IC 741.
5.	Design and simulate Second Order low pass filter / high pass filter. Also verify its frequency response characteristics.
6.	A. Design and simulate Astable & Monostable Multivibrator circuits using IC 741 B. Design and verify Astable and Bistable Multivibrator circuits using IC 555
7.	A. Verify and simulate Schmitt Trigger circuits using IC 741 B. Design of a Half Wave and Full Wave Rectifier using IC 741
8.	To construct a RC Phase Shift oscillator and study its operation.
9.	To verify the operation of various types of clippers and clampers like positive and negative using opamp 741.
10.	To study and verify PLL using IC 565
11.	Verification of Digital to Analog converter using R- 2R ladder circuit.
12.	Mini Project

V Semester
ET 2303 – FIELDS & RADIATING SYSTEMS

Course Learning Objectives	Course Outcomes
The student should be able to	**The student will be able to**
1) Learn concept of Transmission lines and its parametric analysis 2) Understand the concept of parallel plane waveguide. 3) Understand the concept of rectangular waveguide 4) Understand the fundamentals of antenna and antenna arrays	1) Estimate transmission lines parameters 2) Illustrate parallel plane waveguides, and rectangular waveguides 3) Analyze antenna parameters 4) Explain various types of antennas

Unit No.	Contents	Max. Hrs.
1	**Transmission Lines** Introduction to transmission line theory, Transmission line parameters, Characterized impedance, Propagation constant, Phase constant, Attenuation constant, Waveforms distortion, Distortion less transmission lines, Loading of transmission lines, Reflection coefficient and VSWR, Equivalent circuits of transmission lines, Transmission lines at radio frequency. Open and short circuited lines, Smith chart.	6
2	**Parallel Planes Waveguide** Guided Waves between parallel planes, Derivation of TE wave, Derivation of TM wave Characteristics of TE and TM wave, TEM waves and its characteristics.	6
3	**Rectangular Waveguide** Introduction to rectangular waveguide, TM wave in rectangular waveguide, TE wave in rectangular waveguide, Characteristics of TE and TM wave in rectangular waveguide, Velocity, Guide wave length, Wave impedance, Field configurations. Introduction to Circular Waveguide	6
4	**Antenna Terminology** Retarded potentials, Field due to a current elements, Power radiated and radiation resistance, Far field due to a dipole, Reciprocity theorem applied to an antennas gain, Aperture of antenna, Radiation intensity, Directivity and antenna gain.	6
5	**Antenna Arrays** Two elements arrays and their directional characteristics, Linear arrays analysis, Broadside and End fire arrays, Pattern multiplication, Binomial arrays, Design of broadside array for a specific Pattern.	6
6	**Types of Antenna** Log –periodic antennas, horn antennas& Lens Antennas, New topic to be announced time to time	6

V Semester
ET 2303 – FIELDS & RADIATING SYSTEMS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Antenna Theory And Waveguide	3rd Edition	K.D.Prasad	Satya Prakashan ,New Delhi
2	Electromagnetic wave And Radiating System	2nd Edition	Jordan and Balmain	Prentice hall
3	Antenna Theory & Design	3rd Edition	C.A.Balanis	John Wiley & sons
4	Antennas	5th Edition	John D. Krauss	McGraw-Hill International edition

V Semester

ET 2304 – SIGNALS & SYSTEMS

Course Learning Objectives	Course Outcomes
The student should be able to	**The student will be able to**
1) Understand the fundamental characteristics of signals and systems. 2) Understand signals and systems in terms of both the time and transform domains. 3) Understand the process of sampling and interpolation. 4) Develop of the mathematical skills to solve problems involving convolution, transforms and sampling.	1) Classify systems based on their properties and determine the response of LTI system. 2) Analyze system properties based on impulse response and Fourier analysis. 3) Sample and reconstruct the signals. 4) Apply the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems.

Unit No.	Contents	Max. Hrs.
1	**Signals and Systems.** Continuous-Time and Discrete-Time Signals. Transformations of the Independent Variable. Continuous-Time and Discrete-Time Systems. Basic System Properties. Discrete-Time LTI Systems: The Convolution Sum. Continuous-Time LTI Systems: The Convolution Integral. Properties of Linear Time-Invariant Systems. Causal LTI Systems Described by Differential and Difference Equations. Singularity Functions.	6
2	**Fourier Series Representation of Periodic Signals.** The Response of LTI Systems to Complex Exponentials. Fourier Series Representation of Continuous-Time Periodic Signals. Convergence of the Fourier series. Properties of Continuous-Time Fourier Series. Fourier Series Representation of Discrete-Time Periodic Signals. Properties of Discrete-Time Fourier Series. Fourier Series and LTI Systems. Filtering.	6
3	**Fourier Transform.** The Continuous-Time Fourier Transform. Representation of Aperiodic Signals: The Continuous-Time Fourier Transform. The Fourier Transform for Periodic Signals. Properties of the Continuous-Time Fourier Transform. The Discrete-Time Fourier Transform. Representation of Aperiodic Signals: The Discrete-Time Fourier Transform. The Fourier Transform for Periodic Signals. Properties of the Discrete-Time Fourier Transform.	6
4	**Time & Frequency Characterization of Signals and Systems.** The Magnitude-Phase Representation of the Frequency Response of LTI Systems. Concept of Frequency Response, Group Delay and Phase Delay. Time-Domain Properties of Ideal Frequency-Selective Filters. Time- Domain and Frequency-Domain Aspects of Non ideal Filters. Representation of a Continuous-Time Signal by Its Samples: The Sampling Theorem. Reconstruction of a Signal from Its Samples Using Interpolation. Aliasing. Discrete-Time Processing of Continuous-Time Signals.	6
5	**The Laplace Transform.** The Laplace Transform. The Region of Convergence for Laplace Transforms. The Inverse Laplace Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the Laplace Transform. Analysis and Characterization of LTI Systems Using the Laplace Transform. System Function Algebra and Block Diagram Representations. The Unilateral Laplace Transform.	6

V Semester
ET 2304 – SIGNALS & SYSTEMS

6	**The Z-Transform.** The z-Transform. The Region of Convergence for the z-Transform. The Inverse z-Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the z-Transform. Analysis and Characterization of LTI Systems Using z-Transforms. System Function Algebra and Block Diagram Representations. The Unilateral z-Transform. **New topic to be announced time to time**	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Signals and Systems	2nd edition	Alan V. Oppenheim,Alan S. Willsky, with S. Hamid	Prentice Hall.
2	Schaum's Outline of Signals and Systems.	4th edition 2002	Hwei Hsu,	McGraw-Hill

Reference Books

SN	Title	Edition	Authors	Publisher
1	Principles of Signal Processing and Linear Systems	1st edition	B. P. Lathi	Oxford University Press
2	Signals & Systems	2nd Edition. 2005	Simon Haykin and Van Veen, Wiley	TMH
3	Signals & Systems Analysis Using Transformation Methods & MAT Lab	1st edition 2003.	Robert	McGraw-Hill Companies
4	Signals, Systems and Transforms	3rd Edition, 2004.	C. L. Philips, J.M.Parr and Eve A.Riskin	Pearson education

V Semester

ET 2305– LAB: SIGNALS & SYSTEMS

Course Learning Objectives	Course Outcomes
The student should be able to 1) Understand the fundamental characteristics of signals and systems. 2) Understand signals and systems in terms of both the time and transform domains. 3) Understand the process of sampling and interpolation. 4) Develop of the mathematical skills to solve problems involving convolution, transforms and sampling.	**The student will be able to** 1) Classify systems based on their properties and determine the response of LTI system. 2) Analyze system properties based on impulse response and Fourier analysis. 3) Sample and reconstruct the signals. 4) Apply the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems.

Sr. No.	Name of Experiment
1.	Understanding the Basic Signals
2.	Properties of signals and their transformations
3.	Introduction to systems and their classification.
4.	Characterizations of System.
5.	Convolution of Continuous Time and Discrete Time Signals
6.	Implementation of Fourier series
7.	Implementation of Continuous time Fourier Transform
8.	Implementation of Discrete time Fourier Transform
9.	Implementation of Laplace Transform
10.	Implementation of z-Transform
11.	Sampling and reconstruction

V Semester
ET 2306– LAB: ELECTRONICS WORKSHOP

Course Learning Objectives	Course Outcomes
The student should be able to 1) Learn identifications, operation & testing of passive and active electronic components and devices. 2) Understand identification and Testing of wires, cables, connectors and interconnected components. 3) Understand PCB designing process, soldering process, testing and troubleshooting of electronic circuits	**The student will be able to** 1. Identify and test passive and active electronic components and devices. 2. Identify and Test wires, cables, connectors and interconnected components. 3. Develop mini project

Expt. No.	Experiments based on
01	To study Analog and Digital Multimeter.
02	To study Passive electronic components.
03	To study Active electronic components.
04	To identify and Test wires, cables and connectors.
05	To study Operation, Identification and Testing of Interconnected components.
06	To study Operation and Testing of microphones and speakers.
07	To construct a Fixed voltage regulated power supply.
08	To perform Bread board execution of the mini project.
09	PCB layout designing and fabrication.
10	Testing and Fault rectification in mini project.

V Semester
ET 2311– OE I: MICROCONTROLLER & EMBEDDED SYSTEMS

Course Learning Objectives	Course Outcomes
The student should be able to 1) To understand the architecture and pin functions of 8 bit microcontroller. 2) To study the assembly language instruction set. 3) To understand programming microcontroller in C language. 4) To understand interfacing of on and off chip peripherals with 8051 microcontrollers	**The student will be able to** 1) Elaborate 8051 microcontroller architecture. 2) Develop assembly and embedded C language program. 3) Interface 8051 microcontroller with different peripherals 4) Examine Arduino architecture

Unit No.	Contents	Max. Hrs.
1	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	6
2	Addressing modes, Instruction set and Assembly language programming Programs using look up table, Bit manipulation, 8051 I/O programming, Delay Programs.	6
3	I/O Interfacing such as LED, switches, 7segment display, keyboard matrix programming, 8051 programming in C: Data types and time delay, I/O programming, Logic operations, Data conversion programs, Lookup table access	6
4	Timer programming in assembly and C: Various modes of operation, SFR related to timer operation. Serial Port programming in assembly and C: Basics of serial communication, 8051 connection to RS 232. Serial data transfer programs.	6
5	Interfacing of LCD, ADC, DAC, stepper motor and DC motor with 8051 microcontroller	6
6	Block diagram of Arduino, features of Arduino Architecture, Arduino pin description: digital pins, analog pins, Power pins and other pins, Interfacing of LED, 7-Segment display, LCD, Sensors, DC motor, switch and Serial communication. New topic to be announced time to time .	6

V Semester
ET 2311– OE I: MICROCONTROLLER & EMBEDDED SYSTEMS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	The 8051 Microcontroller and Embedded systems using assembly & C	2nd edition	by Muhammad Ali Mazidi	Pearson Education Asia LPE
2	Programming and Customizing the 8051 Microcontroller		By MykePredko	McGraw-Hill
3	The 8051 Microcontroller	3rd edition	By Kenneth Ayala	CENGAGE Learning
4	Arduino Development Cookbook		Cornel Amariei	PACKT Publishing

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets	Douglas V Hall	Tata McGraw Hill	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets
2	Microprocessor & Interfacing	A. K. Ray, K. M. Bhurchandi.	Tata McGraw Hill	Microprocessor & Interfacing

V Semester
ET 2312– OE I: PRINCIPLES OF COMMUNICATION ENGINEERING

Course Learning Objectives	Course Outcomes
The student should be able to 1) Understand various modulation and demodulation techniques of analog and digital modulation. 2) Describe and determine the performance of different error control coding schemes for the reliable transmission of digital representation of signals and information over the channel. 3) Understand various multiple access techniques in wire and wireless communication 4) To learn the basic of satellite communication and elements of optical fiber transmission	**The student will be able to** 1. Describe analog and digital communication systems and various modulation schemes. 2. Analyze error correcting codes, including block codes. 3. Illustrate multiple access techniques in wired and wireless communication. 4. Discuss the different applications of satellite communication and optical communications

Unit No.	Contents	Max. Hrs.
1	**ANALOG COMMUNICATION** Introduction to Communication Systems; Noise, Types of noise, sources of noise; Need for modulation, AM-Time domain representation, Frequency spectrum, power relations, DSB/SC, SSB Angle modulation**.**	6
2	**DIGITAL COMMUNICATION** Introduction Digital Communication System; Pulse modulations – concepts of sampling and sampling theorems, PAM, PWM, PPM; Waveform coding Techniques: Pulse code Modulation (PCM), Delta Modulation, Adaptive Delta modulation.	6
3	**Digital Modulation** Data formats; Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Phase Shift Keying (PSK) – BPSK – QPSK– Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM ; Bandwidth Efficiency; Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).	6
4	**SOURCE CODES, LINE CODES & ERROR CONTROL** Entropy, Properties of entropy; source coding: Huffman coding**;** error control codes and applications: convolutions & block codes.	6
5	**MULTIPLE ACCESS TECHNIQUES** FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages (merits)	6
6	**SATELLITE, OPTICAL FIBER – POWERLINE, SCADA** types of satellites , frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite – Intelsat and Insat; fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications SCADA**,** New topic to be announced time to time	6

V Semester
ET 2312– OE I: PRINCIPLES OF COMMUNICATION ENGINEERING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Principles of Communication Systems	2007	Taub &Schiling	Tata McGraw Hill
2	Principles of Digital Communication	1986	J.Das	New Age International

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Electronic Communication Systems	4th Edition, 1993	Kennedy and Davis	Tata McGraw hill
2	Digital Communication Fundamentals and Applications	2001	Sklar	Pearson Education
3	Digital Communication	2004.	Bary le, Memuschmidt	Kluwer Publication

V Semester
ET 2313– OE I: FUNDAMENTALS OF IMAGE PROCESSING

Course Learning Objectives	Course Outcomes
The student should be able to 1) Learn the fundamentals of digital image processing algorithms. 2) Learn the algorithms of spatial and frequency domain filtering. 3) Learn segmentation of digital images through various algorithms 4) Learn representation and recognition of digital images through various algorithms	**The student will be able to** 1) Examine the concepts of image enhancement, segmentation, representation and recognition 2) Apply basic image processing algorithms and filtering techniques for image enhancement. 3) Apply the algorithms for image segmentation 4) Apply the techniques for image representation and recognition

Unit No.	Contents	Max. Hrs.
1	**Introduction** Origin of Digital Image processing, Fundamental Steps in image processing, Component of Image processing system, Sampling and quantization, Interpolation Techniques, Geometric transformation, Concept of gray levels, Relationship between pixels, Applications of Image Processing.	6
2	**Intensity Transformations** Background, Basic intensity transformation techniques: Image negative, log transformation, power law transformation, piecewise linear transformation, Histogram processing: Histogram Equalization, Histogram Matching, Local histogram processing.	6
3	**Spatial and Frequency Domain Filtering** Mechanics of Spatial filtering, Smoothing spatial filters: Linear and Order statistic filters, Sharpening filters: Foundation, Laplacian and Gradient, Filtering in frequency domain	6
4	**Image Segmentation** Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region based segmentation.	6
5	**Representation and Description** Representation, Boundary Descriptors, Regional Descriptor	6
6	**Object Recognition** Patterns and Pattern Classes, Recognition based on decision Theoretic Methods, Structural Methods, **New topic to be announced time to time**	6

		June 2020	1.02	Applicable for AY2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
ET 2313– OE I: FUNDAMENTALS OF IMAGE PROCESSING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Digital Image Processing	2nd edition	R.C. Gonzalez & R.E. Woods	Addison Wesley/Pearson education publication 2002.
2	Digital Image Processing	4th edition	William K. Pratt	A John Wiley & Sons, Inc., Publication

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Digital Image Processing		Anil K. Jain	PHI
2	Digital Image Processing		S. Jayaraman, S. sakkirajan, T Veerakumar	McGraw-Hill

V Semester
ET 2321-OE II: SOFT COMPUTING

Course Learning Objectives	Course Outcomes
The student should be able to 1) Familiarize with soft computing concepts. 2) Learn the concepts of Genetic algorithm 3) Learn the concepts of Fuzzy Logic and Neural networks	**The student will be able to** 1) Examine genetic algorithms, fuzzy logic and neural network techniques 2) Apply genetic operators and genetic algorithms for problem solving 3) Apply Neural Network algorithms in pattern recognition 4) Apply fuzzy logic to solve engineering problems

Unit No.	Contents	Max. Hrs.
1	**Genetic Algorithm** Basic terminologies used in Genetic Algorithm, Simple GA, General Genetic Algorithm, Encoding, Selection, Crossover, Mutation, Stopping Condition for GA, Constraint in GA	6
2	**Neural Networks** Biological Neurons and Their Artificial Models, Models of Artificial Neural Networks, Learning Methods, Activation Functions, McCulloch-Pitts Neuron Model, Neural Network Learning Rules, Application of NN	6
3	**Supervised Learning** Single Layer Perceptron, Back propagation algorithm, Associative Memory.	6
4	**Unsupervised Learning** Hamming and Max net, Competitive Learning, self-organizing feature maps, ART Networks, RBF	6
5	**Fuzzy Sets and Operations** Concepts of Fuzzy sets, extension principle Operation on fuzzy sets, Fuzzy numbers, arithmetic operations, Lattice, fuzzy equations	6
6	**Fuzzy logic and Systems** Fuzzy relations Fuzzy Logic, Approximate Reasoning, Fuzzy controllers, Defuzzification Methods, Fuzzy Inference Techniques, Applications, **New topic to be announced time to time**	6

V Semester
ET 2321-OE II: SOFT COMPUTING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fuzzy sets and Fuzzy logic	1995	By George Klir, Bo Yuan	PHI
2	Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications	2003	By S. Rajsekharan, VijayalaxmiPai	PHI
3	Elements of Artificial Neural Network	1997	By K. Mehrotra	MIT Cognet

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Neural Networks, a comprehensive foundation	1999	By Simon Haykins	PHI
2	Artificial Neural Networks	2004	By B. Yegnanarayana	PHI
3	Fuzzy Logic & Applications	2003	By T. Ross	McGraw Hill
4	Soft Computing,	2011	Sivanandanam and Deepa	Wiley

V Semester
ET 2322– OE II: INDUSTRIAL INSTRUMENTATION

Course Learning Objectives	Course Outcomes
The student should be able to 1) Study the characteristics of Instruments. 2) Understand the Concepts of Pressure measurements and its calibration process 3) Understand the working principle of various active &passive temperature transducers. 4) Learn the working principle of various flow transducers. 5) Learn the working principle of various transducers like level, thickness speed, ph value etc. 6) Learn automation system components.	**The student will be able to** 1) Explain instrumentation system 2) Analyze pressure, temperature, parameters measured using transducers 3) Analyze flow, speed and level parameters measured using transducers 4) Elaborate automation system components.

Unit No.	Contents	Max. Hrs.
1	**INTRODUCTION** Block diagram of instrumentation system, static and dynamic characteristics of instruments, functions of instruments, Definition of Transducers- Role of transducers in instrumentation- Advantages of electrical transducers – Classification of transducers- Analog and Digital, Active and passive, Primary and Secondary transducers- Inverse transducer-Sensitivity and specification for transducers - Characteristics and Choice of transducer-Factors influencing choice of transducer. Need of transducers, Classification, selection criteria. Calibration Process.	6
2	**PRESSURE MEASUREMENT** Units of pressure - Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – Diaphragms– Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezoresistive pressure sensor –Testing and calibration of pressure gauges – Dead weight tester.	6
3	**TEMPARATURE MEASUREMENT 1** Different types of filled in system thermometer , Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics – Three lead and four lead RTDs.	6
4	**TEMPARATURE MEASUREMENT2: THERMOCOUPLES AND PYROMETERS** Thermocouples – Laws of thermocouple – Signal conditioning of thermocouples output –cold junction compensation –Response of thermocouple, Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two color radiation pyrometers.	6
5	**FLOWMETERS** Variable head type flow meters: – Orifice plate – Venturi tube – Pitot tube. Area flow meter: – Rotameter, Principle and constructional details of electromagnetic flow meter – Ultrasonic flowmeters flow measurements for gases	6
6	**MISCELLANEOUS MEASUREMENT** Electrical level gauge: – Resistive , Ultrasonic type, Radar type ,Speed measurement -D.C and A.C Tacho generators ,rotary encoder, Proximity sensors- Inductive and capacitive, Introduction to PLC, SCADA. **New topic to be announced time to time**	6

		June 2020	1.02	Applicable for AY2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
ET 2322– OE II: INDUSTRIAL INSTRUMENTATION

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Industrial Instrumentation and Control	2003	S.K. Singh	Tata McGraw Hill, 2003.
2	Transducers and Instrumentation		D V S Murthy	prentice Hall of India Pvt. Ltd., New Delhi
3	Electrical and Electronic Measurements AND Instrumentation		A. K. Sawhney	Dhanpat Rai &Co

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Principles of Industrial Instrumentation ata		D. Patranabis T	McGraw Hill Publishing Company Ltd, 1996.
2	Programming for Industrial Automation		Kevin Collins	
3	Instrumentation Measurement & Analysis	2004.	B.C. Nakra & K.K.Chaudary	Tata McGraw Hill Publishing Ltd
4	Measurement Systems – Application and Design	2003	E.O. Doebelin	Tata McGraw Hill publishing company
5	Industrial Instrumentation		D.P. Eckman	Wiley Eastern Ltd.

V Semester
ET 2323– OE II: MEDICAL ELECTRONICS

Course Learning Objectives	Course Outcomes
The student should be able to 1) Know the physiology of heart , brain and skin, Understand the basic principles of physical parameters 2) Comprehend the working principles of measuring, monitoring and recording instruments. 3) Know the physical concepts of radiography related to X rays 4) Learn working principles of advanced medical imaging system	**The student will be able to** 1) Elaborate basic physiological systems of human body 2) Explain the physiological parameter measurement techniques. 3) Explain the working of measuring and recording instruments for physiological parameters. 4) Elaborate the working principles of modern imaging systems

Unit No.	Contents	Max. Hrs.
1	Cell as bio electric generator: Introduction of man instrumentation system, Heart and Circulatory system, Components of man instrumentation system , Brain and nervous system, Physiological system of the body.	6
2	**Physiological parameter Measurement:** Blood pressure and Flow, Heart rate and Heart sounds, Characteristics of blood flow, Respiration and Temperature	6
3	**Recording Instrumentation:** Electrodes, basic instrumentation, Electrocardiograph, Electroencephalograph, ,Electromyograph, Phonocardiograph	6
4	**Measuring Instrumentation:** Transducers, Blood Pressure, Blood flow and Pulse oximeters, Heart rate respiration rate and temperature meters, Audiometer and hearing Aid	6
5	**X-rays:** X-ray Physics, Fluoroscopy and radiography, X-ray tubes and X-ray Equipments, Biomedical computer application	6
6	**Advanced Imaging System:** Ultrasonic scanner, CT scan, MRI, Endoscope and Measurement of blood flow and cardiac Output **New topic to be announced time to time**	6

V Semester
ET 2323– OE II: MEDICAL ELECTRONICS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Medical Electronics	2003	Patil A. G	ISTE Excel book
2	Biomedical Instrumentation and Measurements	Second edition 2004	Leslie Cromweel, Fred J. Weibell, Erich A.	PHI

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Handbook of Biomedical Instrumentation	New Delhi, 2003.	Khandpur, R.S	TATA McGraw Hill
2	Introduction to Biomedical equipment Technology	New York,2004	Joseph J.Carr and John M.Brown	John Wiley and Sons

V Semester
ET 2324– OE II: DISPLAY TECHNOLOGY & APPLICATIONS

Course Learning Objectives	Course Outcomes
The student should be able to 1) To learn fundamental concepts of different display technologies related to manufacturing techniques and materials used for FPD selection. 2) To explore electrical, optical and physical specifications required for display technologies 3) To understand different displays and addressing of displays 4) To learn backplane technology and driver integration 5) To identify and comprehend materials and applications of display	**The student will be able to** 1) Identify different display technologies and manufacturing process. 2) Analyze characteristics of display devices and Luminescence materials. 3) Analyze addressing matrix, TFT backplane and backlight unit technologies. 4) Elaborate advanced display devices and Materials .

Unit No.	Contents	Max. Hrs.
1	Overview of display technologies, emmisive-nonemmisive displays, information capacity of displays, introduction to different flat panel display technologies, Display specifications, display manufacturing process overview	6
2	Characterization and performance of displays: Concepts of aspect ratio, color gamut, contrast and gradation, directional visibility, memory and storage, resolution, addressability, Fundamentals of Photometry, Colorimetry, CIE colorimetry	6
3	Luminescence and luminescent materials: Physical processes and interactions leading to emission of light, Mechanisms of Electron and Hole Recombination in Semiconductors, Recombination Rates of Excess Carriers and Excess-Carrier Lifetimes, Basics of matrix addressing of displays: active and passive matrix.	6
4	Technical discussion of display technologies: TFT, LEDs, OLEDs, LCDs, Active matrix TFT backplanes for OLED and LCD displays. Other displays and associated technologies.	6
5	Advanced TFT Backplane Technologies (IGZO, LTPS, etc.) and Driver Integration. Back Light Unit Technologies (CCFL, LED, QD, etc.)	6
6	Future and New Applications of Displays. Materials for Display – TFT, EL and LC Materials and Modes New topic to be announced time to time	6

V Semester
ET 2324– OE II: DISPLAY TECHNOLOGY & APPLICATIONS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Flat Panel Displays	2008	Jiun-Haw Lee, David N. Liu, Shin-Tson Wu	Wiley publications
2	Fundamentals of Solid-State Lighting: LEDs, OLEDs, and Their Applications in Illumination and Displays	2014	Vinod Kumar Khanna	CRC press

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Liquid crystal displays: fundamental physics and technology.	2011	R. H. Chen	John Wiley and Sons
2	Liquid crystal flat panel displays: manufacturing science & technology.	2012	W. Mara	Springer, Science & Business Media,

V Semester

ET2325– OE II: PLCs and SCADA

Course Learning Objectives	Course Outcomes
Students should be able to: 1) Understand the fundamentals of Automation and their applications, systems used in industry such as PLC, Memory devices, Input /Output system and Relays. 2) Learn PLC and SCADA programs for industrial automation. 3) Understand the concepts of HMI & SCADA 4) Understand the concepts in distributed control systems	**Students will be able to:** 1) Explain the basic building blocks of Programmable logic controller 2) Develop PLC and SCADA programs for industrial automation. 3) Illustrate the concepts involved in HMI & SCADA 4) Elaborate the concepts in distributed control systems

Unit No.	Contents	Max. Hrs.
1	**Introduction to Programmable Controllers** Definition , A Historical Background , Principles of Operation , PLCs Versus Other Types of Controls , PLC Product Application Ranges, Advantages of PLCs, PLC Sizes and Scopes of Applications, Overview of PLC System	6
2	**Introduction to Programming Languages** Types of PLC Languages, Ladder Diagram Format, Ladder Relay Instructions, Ladder Relay Programming, IEC 1131-3 Programming Languages – FBD/ST/IL/SFC **Programming Instructions** NO-NC & coil based instructions (Relay based Instructions), Timers, Counters, Compare, Mathematics, Jump and Subroutines	6
3	**Introduction to SCADA** Introduction and brief history of SCADA, Fundamental principles of modern SCADA systems, the components of a SCADA system, Types of SCADA **SCADA Programming** Graphics Building & Simulation, Tag types & Management, Tools, Programming techniques, Alarms & Trends Configuration, Screen Navigation	6
4	**Introduction to HMI** FOUNDATIONS OF HMI: The Human: History of User Interface Designing, Types, Features, General architecture , Conventional & current HMI systems, Difference between HMI & SCADA, HMI Hardware interfaces, Practical uses in Industries.	6
5	**Data comparison instructions & PLC sequencers** Data comparison instructions such as EQU, LES, and GRT, Introduction to the principles of Data Transfer, Move Instruction, Introduction to Shift Registers & Its types. Purpose and application of PLC Sequencers, Masking techniques and the various types of Sequencers, SQO and SQC instructions.	6
6	**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.	6

V Semester
ET2325– OE II: PLCs and SCADA

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Programmable Logic controllers		Gary Duning	Delmar Thomson Learning
2	SCADA: Supervisory Control and Data Acquisition	Fourth Edition	Stuart A Boyer	ISA 1999
3.	Programmable Logic Controllers	Fifth Edition	Frank Petruzella	McGraw-Hill Education

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Programmable logic controller		W. Bolton	Elsevier Publisher

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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

BE SoE and Syllabus 2018

(Revised Scheme of Examination w.e.f. 2020-21 onward)

Electronics & Telecommunication Engineering

VI Semester
GE2311 - Fundamentals of Management

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

VI Semester
ET2351 - Digital Signal Processing

Prerequisites	Signals and System
Course Objectives Students should be able to 1) Learn discrete Fourier Transform and Computation of DFT. 2) Understand realization of digital filters in a variety of structures. 3) Study the design of IIR and FIR digital filters. 4) Learn the effects of Finite word length 5) Understand multi-rate discrete time system with unequal sampling rates.	**Course Outcomes** Students will be able to 1) Apply discrete Fourier transform and fast Fourier transform on signals. 2) Implement digital filters in a variety of structures. 3) Design digital IIR and FIR filter. 4) Analyze the effects of finite word length on discrete time system. 5) Analyze multi-rate discrete time system with unequal sampling rates.

UNIT-1 Discrete Fourier transform

Frequency domain sampling: DFT, DFT as Linear transformation, Properties of DFT, Circular convolution, Use of DFT in Linear Filtering, FFT algorithms: Decimation in time, Decimation in Frequency

(06 Hours)

UNIT-2: Digital filter structures

Block diagram representation, Signal Flow Graph, Basic IIR structures, Basic FIR structures, IIR lattice structures, Linear Phase FIR, FIR lattice structure

(07 Hours)

UNIT-3: IIR filter design

Bilinear transformation, Impulse invariant transformation, Low pass IIR digital filters, Butterworth and Chebyshev filter, Spectral transformations.

(06 Hours)

UNIT 4: FIR filter design

FIR filter design using windowing techniques (Rectangular, Hann, Hamm, Blackmann, Bartlett and Kaiser), Frequency sampling technique.

(06 Hours)

Unit 5: Finite Word length Effect

Quantization Process and Errors, Quantization of fixed point and floating points numbers, Analysis of coefficient quantization effects, A/D Conversion Noise analysis, Analysis of round off errors, Dynamic range scaling, Signal to Noise Ratio in Low order IIR Filters, Limit cycles in IIR digital Filters

(05 Hours)

Unit 6: Multirate Digital Signal Processing

Basic sample rate alternation devices, Multirate structure for sampling rate conversion, Multirate Design of Decimator and Interpolator, The Ployphase Decomposition, **New topic to be announced time to time**

(06 Hours)

VI Semester
ET2351 - Digital Signal Processing

Text books:				
1	"Digital Signal Processing - Principles, algorithms and applications"	4th edition, 2013	John G. Proakis	McGraw-Hill
2	"Discrete time Signal Processing"	3rd edition 2010	Alan Oppenheim, Ronald Schafer and Buch	Pearson
3	"Digital Signal Processing - A computer based approach," Publication.	4th edition, 2013	Sanjit K. Mitra,	McGraw-Hill

Reference books:				
1	Digital Signal Processing	3rd Edition 2017	S Salivahanan A Vallavraj C Gnanapriya	McGraw-Hill

VI Semester

ET2352 - Lab: Digital Signal Processing

Course Objectives	**Course Outcomes**
Students should be able to 1) Learn discrete Fourier Transform and Computation of DFT. 2) Understand realization of digital filters in a variety of structures. 3) Study the design of IIR and FIR digital filters. 4) Learn the effects of Finite word length 5) Understand multi-rate discrete time system with unequal sampling rates.	Students will be able to 1) Apply discrete Fourier transform and verify its properties. 2) Implement digital filters in a variety of structures. 3) Design and analyze digital IIR and FIR filter. 4) Analyze the effects of finite word length on discrete time system. 5) Analyze multi-rate discrete time system with unequal sampling rates

Expt. No.	Name of Experiment
1.	To find Discrete Fourier Transform and Inverse Discrete Fourier Transform of discrete time signals
2.	Verify the properties of DFT (Linearity, Time Reversal and Parsevals theorem)
3.	To find circular convolution of two discrete time signals
4.	To verify Circular time shift and Frequency shift Property
5.	To design Butterworth IIR filters.
6.	To design Chebyshev IIR filters.
7.	To design FIR filters using windowing techniques
8.	To Analyze Coefficient Quantization Effect
9.	To Design Decimator
10.	To design Interplotor

VI Semester
ET2361 - PE I : Object Oriented Programming

Course Objectives	**Course Outcomes**
Students should be able to 1. Learn the basic concepts of Object Oriented Programming. 2. Understand the concepts of function, class, object and operator overloading. 3. Understand the fundamentals of data structures: lists, stacks, queues, trees, graphs. 4. Learn concepts of file handling, template, exception handling and command line arguments.	Students will be able to 1. Elaborate the object oriented paradigm with concepts of streams, classes, functions, data and objects. 2. Demonstrate the use of various OOPs concepts with the help of C++ programs. 3. Develop C++ programs for implementing data structures using array and linked list. 4. Apply the knowledge of BFS,DFS and Dijkstra`s algorithm for traversal of Graph. 5. Develop C++ programs for implementing the concept of file handling, template and exception handling

UNIT-1:
Principles of Object Oriented Programming (OOP), Software Evaluation, OOP Paradigm, Basic Concepts of OOP, Benefits of OOP, Application of OOP. Introduction to C++, Tokens, Keywords, Identifiers, Variables, Operators, Manipulators. Expressions and Control Structures, Pointer, Arrays **06Hrs**

UNIT-2:
Functions, Function Prototyping Parameters Passing in Functions, Values Return by Functions, Inline Functions, Friend and Virtual Functions. Classes and Objects, Constructors and Destructors
06Hrs

UNIT-3:
Operator overloading, Function Overloading, Inheritance, Types of Inheritance, Polymorphism, Friend and Virtual Functions.
06 Hrs

UNIT-4:
Definition of a data structure, Primitive and Composite data types, Asymptotic notations, Operations of Arrays, Order lists, Stacks, Applications of Stack, Infix to Postfix Conversion, Queues, Operations of Queues.
06 Hrs

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.
06Hrs

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.
New topic to be announced time to time
06 Hrs

Text books:				
1	Object Oriented programming with C++	3rd. Edition Year 2008	E. Balagurusamy	McGraw-Hill
2	Object Oriented Programming in Microsoft C++	4th edition 2002	Robert Lafore	Galgotia
Reference books:				
1	Fundamental of data structure in C++	5th edition,	Horowitz and S.Shani	Galgotia
2	Computer algorithms	2nd Edition	Horowitz, S.Shani and S.Rajasekaran	Galgotia

VI Semester
ET2362 - Lab.: PE I: Object Oriented Programming

Course Objectives	Course Outcomes
Students should be able to 1. Learn the basic concepts of Object Oriented Programming. 2. Understand the concepts of function, class, object and operator overloading. 3. Understand the fundamentals of data structures: lists, stacks, queues, trees, graphs. 4. Learn concepts of file handling, template, exception handling and command line arguments.	Students will be able to 1. Elaborate the object oriented paradigm with concepts of streams, classes, functions, data and objects. 2. Demonstrate the use of various OOPs concepts with the help of C++ programs. 3. Develop C++ programs for implementing data structures using array and linked list. 4. Apply the knowledge of BFS,DFS and Dijkstra`s algorithm for traversal of Graph. 5. Develop C++ programs for implementing the concept of file handling, template and exception handling

Sr.No.	Name of Experiment
1	To implement • Different Control Structures in C++ • Concept of type casting
2	To implement the concept of • Function • Function overloading
3	To implement concepts of Class, Object And Constructor.
4	To implement concepts of Inheritance and Virtual function
5	To implement concepts of operator overloading.
6	To implement concepts of friend function.
7	To implement Stack and Queue using array
8	To implement Stack and Queue using link list.
9	To implement the concepts of file handling and template.
10	To implement the concept of command line arguments and exception handling

VI Semester

ET2363 - PE I : Discrete Structures

Course Objectives	**Course Outcomes**
Students should be able to 1. Learn algorithms related to discrete mathematics. 2. Study encryption and decryption security algorithm. 3. Understand basic concepts of permutations and combinations. 4. Understand basic concepts of graphs. 5. Understand basic concepts of various tree traversal methods. 6. Study the fundamentals of network models.	Students will be able to 1. Examine logic and proof concepts. 2. Develop recursive algorithms and recurrence relations. 3. Use concepts of counting methods, and the pigeonhole principle 4. Design applications using graphs, tree, group theory in computer science 5. Apply transport network and pumping network models for problem solving

UNIT-1: LOGIC AND PROOFS, & Boolean Logic:

Propositions, conditional propositions and logical equivalence, quantifiers, proofs, resolution proofs, mathematical induction, sets, sequences and strings, relations, equivalence relations, matrices of relations, functions, Boolean algebra, Boolean functions and synthesis of circuits. **06 Hrs**

UNIT-2: ALGORITHMS:

Introduction, Notation for algorithms ,The Euclidean algorithm, Recursive Algorithms , Complexity of Algorithms, Design and Analysis of an Algorithm, Analysis of Euclidean Algorithm , Encryption and decryption, The RSA Public – Key Cryptosystem. **06 Hrs**

UNIT-3: COUNTING METHODS, AND THE PIGEONHOLE PRINCIPALE:

Basic Principles, Permutation and Combination, Algorithms for Generating Permutations and Combinations, Introduction to Discrete Probability, Discrete Probability Theory, Generalized Permutation and Combinations, Binomial Coefficients and Combinatorial Identities, The Pigeonhole Principle. **06 Hrs**

UNIT-4: RECURRENCE RELATIONS & GRAPH THEORY:

Introduction, Solving Recurrence Relations, Application to the Analysis of Algorithms, Paths and Cycles, Hamiltonian Cycle and the Traveling Salesperson Problem, A Shortest Path Algorithm,

Graphs: Representations of Graphs, Isomorphism's of Graphs, Planer Graphs . **06 Hrs**

UNIT-5: TREES:

Introduction, Terminology and Characterization of Trees, Spanning Trees, Minimal Spanning Trees, Binary Trees, Tree Traversal, Decision Trees and the minimum Time for Sorting, Isomorphisms of Trees, Game Trees. **06Hrs**

UNIT-6:

NETWORKS MODELS:

Introduction, A Maximal Flow Algorithm, The Max Flow, Min Cut Theorem, Matching, **Group & Ring Theory**: Definition and examples of groups, subgroups & rings.

New topic to be announced time to time **06 Hrs**

Text books:				
1	Discrete Mathamatics	5th Edition 2002,	Richard Johnsonbaugh.	Pearson Education
2	Elements of Discrete Mathematics: A Computer Oriented Approach	2017	C. L. Liu, D. P. Mohapatra	TMH

VI Semester

ET2364 - Lab. : PE I : Discrete Structures

Course Objectives	**Course Outcomes**
Students should be able to 1. Learn algorithms related to discrete mathematics. 2. Study encryption and decryption security algorithm. 3. Understand basic concepts of permutations and combinations. 4. Understand basic concepts of graphs. 5. Understand basic concepts of various tree traversal methods. 6. Study the fundamentals of network models.	Students will be able to 1. Examine logic and proof concepts. 2. Develop recursive algorithms and recurrence relations. 3. Use concepts of counting methods, and the pigeonhole principle 4. Design applications using graphs, tree, group theory in computer science 5. Apply transport network and pumping network models for problem solving

S.N.	Experiment Based on
1.	Propositional LOGIC
2.	PROOFS
3.	Boolean functions, implementation of combinational logic circuit
4.	The Euclidean algorithm, GCD Algorithm
5.	The RSA Public – Key Cryptosystem
6.	Permutation and Combination
7.	Recursive Algorithms
8.	Discrete Probability
9.	Second order homogeneous recurrence relation with initial conditions
10.	Sorting/searching Algorithms
11.	Experiment on Group theory & Rings concepts
12.	**Group Activity**

VI Semester

ET2365 - PE I : Microprocessors and Peripherals

Course Objectives	**Course Outcomes**
Students should be able to 1. Understand the architectural details & instruction set of 8085 2. Understand concept of timing diagrams, delay programs , interrupts & learn interfacing of memory ICs with the processor 3. Understand interfacing of various off chip peripherals with 8086 4. Understand the architectural details of 8086 5. Understand basics of assembly language programming using 8086 instructions	Students will be able to 1. Elaborate architecture and instructions of 8085 and 8086 microprocessor. 2. Analyze timing diagrams and interrupt structure of 8085 microprocessor. 3. Explain functioning of 8255, 8253 and 8257 peripheral ICs 4. Develop programs using 8085 and 8086 instruction sets. 5. Interface various off chip peripherals with 8085.

Unit I:-
8085 microprocessor architecture, instruction set & programming (6 hrs)

Unit II:
Timing diagrams, Delay programs, interrupts in 8085 (6 hrs)

Unit III:
Memory IC interfacing with 8085, interfacing of 8255 , 8253 with 8085 (6 hrs)

Unit IV:
Interfacing of ADC, DAC & 8257 with 8085 (6 hrs)

Unit V:
Introduction to 16 bit microprocessor family, architecture of 8086 ,segmentation, memory organization, pipelining, Signal description, fetch read &write cycle, minimum mode system, Maximum mode of 8086 (6 hrs)

Unit VI:
8086 Instruction set & programming, **New topic to be announced time to time** (6 hrs)

Text books:				
1	Microprocessor & interfacing		By Ramesh Gaonkar	New Age international
2	Advanced Microprocessors & Peripherals	Second Edition	By A.K Ray , K M Bhurchundi	McGraw Hill
Reference books:				
1.	8085 microprocessor & its applications	Third edition	A. NagoorKani	McGraw Hill
2.	8086/8088 family architecture, interfacing & programming		By D V Hall	McGraw Hill

VI Semester

ET2366 - PE I : Lab. Microprocessors and Peripherals

Course Objectives	**Course Outcomes**
Students should be able to 1. Understand the architectural details & instruction set of 8085 2. Understand concept of timing diagrams, delay programs , interrupts & learn interfacing of memory ICs with the processor 3. Understand interfacing of various off chip peripherals with 8086 4. Understand the architectural details of 8086 5. Understand basics of assembly language programming using 8086 instructions	Students will be able to 1. Elaborate architecture and instructions of 8085 and 8086 microprocessor. 2. Analyze timing diagrams and interrupt structure of 8085 microprocessor. 3. Explain functioning of 8255, 8253 and 8257 peripheral ICs 4. Develop programs using 8085 and 8086 instruction sets. 5. Interface various off chip peripherals with 8085.

S.N.	Experiments based on
01	Perform Basic arithmetic & logical operations
02	Transfer data bytes from one memory block to another
03	Find Smallest / Largest number from a data block
04	Sort /Count number of even & odd data bytes in a array
05	Convert BCD number to equivalent hex
06	Generate square wave using 8255
07	Interface DAC with 8085 & write program to generate sawtooth waveform
08	Solve equation using shift & add method
09	Convert data string to its equivalent 2's compliment
10	Transfer array of data bytes from source memory to destination memory using string instructions
11	Search a byte in an array of data bytes present in memory by using string instructions.
12	Compare two data blocks using string instructions

VI Semester
ET2367 - PE I : Electronic Instrumentation

Course Objectives	Course Outcomes
Students should be able to 1. Study the characteristics of Instruments. 2. Understand the Concepts of Pressure and temperature Measurements and its calibration process. 3. Learn the working principle of various flow & level transducers. 4. Learn the working principle of various transducers like level , thickness speed, ph value etc. 5. Learn Programmable logic controller and their programming language	Students will be able to 1. Explain electronic instrumentation system 2. Analyze pressure, temperature, parameters measured using transducers 3. Analyze flow, speed and level parameters measured using transducers 4. Develop PLC programs by using ladder diagram

UNIT-I INTRODUCTION
Block diagram of instrumentation system, functions of instruments, characteristic equation of instrument in general form, calibration process, cables and connectors and its analysis.
05 Hours

UNIT-II PRESSURE MEASUREMENT
Units of pressure - Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – Diaphragms – Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezo resistive pressure sensor –Testing and calibration of pressure gauges – Dead weight tester.
06 Hours

UNIT-III TEMPARATURE MEASUREMENT, THERMOCOUPLES AND PYROMETERS
Different types of filled in system thermometer , Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics – Three lead and four lead RTDs and their circuits. Thermocouples – Laws of thermocouple – Signal conditioning of thermocouples output –cold junction compensation – Response of thermocouple, Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two color radiation pyrometers.
07 Hours

UNIT-IV FLOWMETERS& LEVEL MEASUREMENT
Variable head type flow meters: – Orifice plate – Venturi tube – Pitot tube. Variable area flow meter: – Rotameter, Principle and constructional details of electromagnetic flow meter – Ultrasonic flow meters flow measurements for gases. Float type level indication, capacitive, ultrasonic level measurement
06 Hours

UNIT-V MISCELLANEOUS MEASUREMENT
Electrical level gauge: – Resistive , capacitive , Nuclear radiation , Radar type ,Speed measurement -D.C and A.C tacho generators ,rotary encoder, Proximity sensors- Inductive and capacitive, pH Measurement, measurement of AC current by Hall effect transducer.
06 Hours

UNIT- VI Data Logger & PLC
Data Logger, Introduction to PLC, PLC programming, ladder diagram logic for process control applications, Introduction to SCADA**.**
New topic to be announced time to time **06 Hours**

VI Semester

ET2367 - PE I : Electronic Instrumentation

Text books:				
1	Industrial Instrumentation and Control	2003	S.K. Singh	Tata McGraw Hill, 2003.
2	PLC Programming for Industrial Automation		Kevin Collins	
3	Electrical and Electronic Measurement and Instrumentation		A.K.Sawhney	DhanpatRai And Co.
4	Process Control Instrumentation Technology 8th Ed	2014	Curtis D. Johnson	Pearson
Reference books:				
1	Principles of Industrial Instrumentation		D. Patranabis	Tata McGraw Hill Publishing Company Ltd, 1996.
2	Transducers and Instrumentation		D V S Murthy	prentice Hall of India Pvt. Ltd., New Delhi
3	Measurement Systems – Application and Design	2003	E.O. Doebelin	Tata McGraw Hill publishing company
4	Industrial Instrumentation		D.P. Eckman	Wiley Eastern Ltd.

VI Semester
ET2368 - PE I : Lab Electronic Instrumentation

Course Objectives	Course Outcomes
Students should be able to 1. Study the characteristics of Instruments. 2. Understand the Concepts of Pressure and temperature Measurements and its calibration process. 3. Learn the working principle of various flow & level transducers. 4. Learn the working principle of various transducers like level , thickness speed, ph value etc. 5. Learn Programmable logic controller and their programming language	Students will be able to 1. Explain electronic instrumentation system 2. Analyze pressure, temperature, parameters measured using transducers 3. Analyze flow, speed and level parameters measured using transducers 4. Develop PLC programs by using ladder diagram

S. N.	Name of Experiment
01	Measure linear displacement and study input output characteristics of LVDT.
02	To study the temperature versus resistance and V-I characteristics of RTD.
03	Measure Temperature using Thermocouple.
04	Pressure measurement using pressure transducer
05	To measure Strain using Strain Gauge or load cell.
06	Measurement of parameters using different sensors
07	Experiments based on PLC and SCADA
08	Grounding & Shielding of Electronics Devices & Instruments, Human Safety.

VI Semester
ET2371 - PE I: Fundamentals of Computing

Course Objectives	**Course Outcomes**
Students should be able to 1. Understand the use of Python as a scripting language for programmers. 2. Learn Python programming and to design applications	Students will be able to 1. Explain Python framework 2. Develop Python programs using data types, operators and control structures 3. Apply strings, lists, tuples, Numpy and dictionaries for Python programs. 4. Develop Python programs using functions

UNIT-1
Introduction to Python ,Python syntax ,comments variables, basic programming **(06 Hours)**

UNIT-2:
Data types, numbers, Casting strings Booleans, python operators: basic, membership and bitwise **(06 Hours)**

UNIT-3:
Conditions, Control statements: if-else, loops, Use of while loops in python Loop manipulation using pass, continue, break and else **(06 Hours)**

UNIT 4
Python String Defining list and list slicing, Use of Tuple data Types **(06 Hours)**

UNIT 5:
List and Dictionary Manipulations Building blocks of python programs **(06 Hours)**

UNIT 6:
Numpy, Functions, recursion and advanced programming **(06 Hours)**

Text books:				
1	NPTEL material		Swayam.gov.in	NPTEL material
2	Complete Reference	Martin C Brown		TATA McGraw Hill
Reference books:				
1.	Core Python Programing	Wesley Chun,		Prentice Hall publications

VI Semester

ET2372 - Lab: PE I -Fundamentals of Computing

Course Objectives	**Course Outcomes**
Students should be able to 1. Understand the use of Python as a scripting language for programmers. 2. Learn Python programming and to design applications	Students will be able to 1. Explain Python framework 2. Develop Python programs using data types, operators and control structures 3. Apply strings, lists, tuples, Numpy and dictionaries for Python programs. 4. Develop Python programs using functions

Expt. No.	**Name of Experiment**
1.	Write, test, and debug simple Python Programs
2.	Develop Python programs using different data types and understand their use
3.	Implement Python programs with conditionals and loops
4.	Implement Python programs with strings
5.	Develop Python programs for Python lists and understand their use
6.	Develop Python programs for Python tuples and understand their use
7.	Develop Python programs step-wise by Python dictionaries for representing compound data.
8.	Develop Python programs step-wise by defining functions and calling them
9.	Read and write data from/to files in Python.
10.	Mini Project

VI Semester

ET2373 - PE I: Algorithms and data structures

Course Objective	Course Outcome
Students should be able to 1. Learn the concepts of object oriented programming using C++. 2. Understand the fundamentals of file handling, streams and formatting I/O operations. 3. Study various data structures and abstract data types. 4. Study concepts of dictionaries; skip list, hashing and search trees.	Students will be able to 1. Describe fundamental concepts of Object Oriented Programming 2. Develop C ++ programs to demonstrate the concepts of Object Oriented Programming 3. Develop programs for implementing data structures. 4. Analyze Skip-list, hashing and search trees.

UNIT-1

software evolution, need for OOP, Overview of OOP Principles- Encapsulation, Inheritance, Polymorphism. C++ class overview- class definition, objects, class members, access control, class scope, constructors and destructors, inline functions, static class members, this pointer, friend functions, dynamic memory allocation and deal location (new and delete) **(06 Hours)**

UNIT-2:

Function overloading, operator overloading, generic programming-function and class templates, Inheritance basics, single inheritance and multiple inheritance, base and derived classes, different types of inheritance, base class access control, virtual base class, function overriding, run time polymorphism using virtual functions, abstract classes. **(06 Hours)**

UNIT-3:

Streams basics, Stream classes hierarchy, console i/o, formatted I/O, manipulators, file streams, opening and closing of files, exception handling mechanism. **(06 Hours)**

UNIT 4

Algorithms, performance analysis-time complexity and space complexity, Review of basic data structures-the list ADT, stack ADT, queue ADT, implementation using template class in C++, implementation using template class, priority queues-definition, ADT, heaps, definition, insertion and deletion, application-heap sort, disjoint sets-disjoint set ADT, disjoint set operations. **(06 Hours)**

UNIT 5:

Skip lists and Hashing: Dictionaries, linear list representation, skip list representation, operations-insertion, deletion and searching, hash table representation, hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing, rehashing, extendible hashing, comparison of hashing and skip lists**.** **(06 Hours)**

UNIT 6:

Binary search trees, definition, ADT, implementation, operations- Searching, insertion and deletion, Balanced search trees- AVL trees, definition, height of an AVL tree, representation, operations-insertion, deletion and searching. Red –Black trees-representation, insertion, deletion, searching Splay trees- introduction, the splay operation . **(06Hours)**

VI Semester
ET2373 - PE I : Algorithms and data structures

Text books:				
1	Data structures, Algorithms and Applications in C++	2nd edition August 2004	S. Sahni	University press (India) pvtltd , Orient Longman pvt. ltd.
2	Data structures and Algorithms in C++	2nd Edition.	Michael T. Goodrich, R. Tamassia and D. Mount	John Wiley and Sons.
Reference books:				
1	Data structures and Algorithm Analysis in C++	second editio n.	Mark Allen Weiss	Pearson Education ltd
2	Data structures using C and C++	second editio n 2003	Langsam, Augenstein and Tanenbaum	PHI
3	C++ primer	3rd edition 2000	S.B.Lippman	Pearson education ltd.
4	Problem solving with C++, The OOP	Fourth edition	W.Savitch	Pearson education.
5	Data structures and algorithms in C++	3rd Edition	Adam Drozdek, Thomson	

VI Semester

ET2374 - PE I :Lab Algorithms and data structures

Course Objective	**Course Outcome**
Students should be able to 1. Learn the concepts of object oriented programming using C++. 2. Understand the fundamentals of file handling, streams and formatting I/O operations. 3. Study various data structures and abstract data types. 4. Study concepts of dictionaries; skip list, hashing and search trees.	Students will be able to 1. Describe fundamental concepts of Object Oriented Programming 2. Develop C ++ programs to demonstrate the concepts of Object Oriented Programming 3. Develop programs for implementing data structures. 4. Analyze Skip-list, hashing and search trees.

Expt. No.	Experiments based on
01	Study of control Structure & Statements
02	Study of If –else structure
03	Study of Case Statement
04	Study of Functions
05	Study of inheritance
06	Study of polymorphism
07	Study of Structures
08	Study of Linked List
09	Study of Stacks
10	Study of queues
11	Study of Trees

VI Semester
ET2377 - PE II : Antenna Theory & Design

Course Objective	Course Outcome
Students should be able to 1. Learn the basic principles and of antenna parameters. 2. Design and analyze dipole antennas. 3. Design and analyze loop antennas & Arrays. 4. Design and Analyze Travelling wave & Broadband Antennas. 5. Design & Analyze aperture, Reflector and Patch Antennas. 6. Study different antenna measurements.	Students will be able to 1. Evaluate various parameters of antennas. 2. Analyze performance parameters of various antennas & antenna array. 3. Perform antenna measurements using different antenna measurement techniques. 4. Design and Analyze various antennas

UNIT I : BASIC ANTENNA CONCEPTS:
Introduction to antenna , need of Antenna, Types of antennas, Radiation mechanism of single wire and two wire , Radiation Pattern, Antenna field zones, Beam solid angle, radiation power density , radiation intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Polarization, impedance, bandwidth, impedance, effective length and equivalent area

(6 Hours)

UNIT II : DIPOLE ANTENNA:
Vector potentials for electric current source , Vector potentials for Magnetic current source, Infinitesimal Dipole, Finite dipole, Half wavelength dipole.

(6 Hours)

UNIT III : LOOP ANTENNAS AND ARRAYS:
circular loop ,polygonal loop and ferrite loop antenna, Two element array, N-element linear array ,broad side, end fire, phase array , planar Array system.

(6 Hours)

UNIT IV : TRAVELING WAVE ANTENNA
Introduction to traveling wave antenna, long wire, V antenna, rhombic antenna, Helical antenna, Electric - Magnetic Dipole, Yagi - Uda array of linear Elements.

(6 Hours)

UNIT V: SPECIAL ANTENNAS:
Babinet's principle, Rectangular Horn antenna, conical horn, corrugated Horn, plane reflector antenna, corner reflector antenna, parabolic reflector antenna, Cassegrain reflector antenna, Patch Antenna, antenna feeding techniques.

(6 Hours)

UNIT VI: ANTENNA MEASUREMENTS
Antenna reflection Ranges, Antenna Free space Ranges, Anechoic Chamber, Near field to farfield method, instrumentation system for measurement, Gain Measurement, Impedance Measurement, Current Measurement, Polarization Measurement. **New topic to be announced time to time**

(06 Hours)

VI Semester
ET2377 - PE II : Antenna Theory & Design

Text books:				
1.	Antenna Theory Analysis and Design Technology	2009 Third edition	Balanis C.A	Wiley India
2.	Antennas	Second edition 1988	John D.Krauss	McGraw - Hill International edition
Reference books:				
1.	Electromagnetic waves and Radiating systems	1993	Edward C.Jordan, Keith G.Balmain	Prentice Hall of India.
2.	Antennas and Radio Propagation	1985	R.E. Collins	McGraw-Hill

VI Semester

ET2378 - PE II : Lab. Antenna Theory & Design

Course Objective	**Course Outcome**
Students should be able to 1. Learn the basic principles and of antenna parameters. 2. Design and analyze dipole antennas. 3. Design and analyze loop antennas & Arrays. 4. Design and Analyze Travelling wave & Broadband Antennas. 5. Design & Analyze aperture, Reflector and Patch Antennas. 6. Study different antenna measurements.	Students will be able to 1. Evaluate various parameters of antennas. 2. Analyze performance parameters of various antennas & antenna array. 3. Perform antenna measurements using different antenna measurement techniques. 4. Design and Analyze various antennas

SN	List of Experiment
1	To measure radiation Pattern of Yagi-Uda Antenna and its Characteristic using Antenna trainer Kit.
2	To measure radiation Pattern of Log Periodic Antenna and its Characteristic using Antenna trainer Kit.
3	To measure radiation Pattern of λ/2 Dipole Antenna and its Characteristic using Antenna trainer Kit.
4	To measure radiation Pattern of 3λ/2 Dipole Antenna and its Characteristic using Antenna trainer Kit.
5	To design and Simulate Patch Antenna with Probe Feed using Simulation software.
6	To design and Simulate Patch Antenna with Microstrip Feed line using Simulation software.
7	To Study parametric analysis of Patch Antenna using Simulation software.
8	To design and Simulate Lambda/2 Dipole Antenna using Simulation software and study it's Characteristic.
9	To design and Simulate Yagi-Uda Antenna using Simulation software and study it's Characteristic.
10	To design and Simulate Horn Antenna using Stimulation software and study it's Characteristic.
11	To design and Simulate Parabolic reflector Antenna using Stimulation software and study it's Characteristic.
12	Study the fabrication process of Antenna
13	Measurement of Antenna Parameter Using Vector Network Analyzer.
14	Mini Project on antenna.

VI Semester

ET2379 - PE II : Digital System Design

Course Objectives	Course Outcomes
Students should be able to 1. Understand programmable devices and discuss the architecture of CPLD and FPGA 2. Learn basics of Hardware description Language, design flow and design Methodology. 3. Understand the concept of modeling digital systems. 4. Understand the concept of generic, generate and attributes. 5. Comprehend combinational and sequential circuit design approaches.	Students will be able to 1. Explain digital system design principles 2. Implement digital circuits using discrete gates and programmable logic devices. 3. Develop Verilog programs for combinational, sequential circuits and test pattern generation. 4. Design a system using CAD tools.

UNIT-1:

Digital Design Fundamentals, Combinational & Sequential design issues, Introduction to finite state machines, Moore & Mealy Machine, 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 **(06 Hours)**

UNIT-2:

HDL Based Design flow, Requirements of HDL, Design Methodologies, Different Modelling styles, Introduction to Verilog, Elements of Verilog, Verilog Module definition, Elements of Module **(06 Hours)**

UNIT-3

Basic Concepts in Verilog, Reserved Keywords, Syntax & Semantics, Comments, Identifiers, Number Representation, System Representation, Verilog Ports, Verilog Data Types, Wire & Variables, Physical & Abstract, Constants, Parameter, Verilog Data Operators, Design entry in Verilog & Testbench, Compilation and synthesis, Timing analysis **(06 Hours)**

UNIT-4:

Data Flow Modelling , Delay, Continuous Assignment, Delayed Continuous assignment, Structural Modelling Feature, Module Instantiation, Gate level Primitives, Gate Delays, Switch Level Primitives, User Defined Primitives

(06 Hours)

UNIT 5:

Behavioural Modelling, Initial, Always, Procedural Assignment, Blocking and Non-Blocking assignments, Sequential & Parallel Blocks, Race around Condition, Timing Control, Procedural Statements, Conditional Statements if case loop repeat forever etc, Zero Delay Control, Event Based Timing Control, Compiler Directives, Assign De-assign, Force Release, Latch Models, FF Models, State Machine Coding ,Moore and Mealy Machines

(06 Hours)

Unit 6: Advanced feature:

Combinational & sequential system Design examples like Shift Registers, Counters, LFSR, Stacks and Queues, Multi bit Adders & Multiplier, Huffman Coding, Processor and Memory Model, CPU, System Tasks and Functions, Design Verification, **New topic to be announced time to time (06 Hours)**

VI Semester

ET2379 - PE II : Digital System Design

Text books:				
1	Verilog Digital System Design"	Zainalabedin Navabi	Second Edition, Tata McGraw Hill ,	2009
2	Verilog HDL : A Guide to Digital Design and Synthesis	Samir Palnitkar	2nd Edition , Prentice Hall India,	2003
Reference books:				
1	A Verilog HDL Primer"	J. Bhaskar,	2nd Edition, Star Galaxy Press	1997

VI Semester

ET2380- PE II : Lab. Digital system Design

Course Objectives	**Course Outcomes**
Students should be able to 1. Understand programmable devices and discuss the architecture of CPLD and FPGA 2. Learn basics of Hardware description Language, design flow and design Methodology. 3. Understand the concept of modeling digital systems. 4. Understand the concept of generic, generate and attributes. 5. Comprehend combinational and sequential circuit design approaches.	Students will be able to 1. Explain digital system design principles 2. Implement digital circuits using discrete gates and programmable logic devices. 3. Develop Verilog programs for combinational, sequential circuits and test pattern generation. 4. Design a system using CAD tools.

Expt. No.	Experiments based on
1	Write a VERILOG code for Basic gates.
2	Write a VERILOG Dataflow code for Half Adder, Half Subtractor.
3	Write a VERILOG Dataflow code for 4:1 MUX, 2:4 Decoder, 1:4 DEMUX.
4	Write a VERILOG Dataflow code for 1-bit, 2-bit Comparator
5	VERILOG code for Full Adder
6	write VERILOG code for Full Subtractor
7	Write Behavioral VERILOG code for SR latch.
8	Write Behavioral VERILOG code for D latch
9	Write Behavioral VERILOG code for 4-bit Shift register, 4-bit counter.
10	Write VERILOG code for 8 Bit Carry Look Ahead Adder using FA.
11	Write VERILOG Code for 4 bit Sequence Detector MEALY M/C, Overlapping allowed
12	Write VERILOG Code for 4 bit Sequence Detector MOORE M/C, Overlapping allowed

VI Semester

ET2381- PE II : Internet of Things (IoT)

Course Learning Objectives	**Course Outcomes**
Students should be able	Students will be able to
1. To understand the physical and Logical design of IoT.	1. Illustrate the physical and Logical design of IoT.
2. To study the M2M and NETCONF.	2. Explain the M2M and NETCONF.
3. To understand python programming.	3. Develop python programs for IoT applications.
4. To understand physical servers and cloud offerings.	4. Design IoT based systems.

UNIT-1: **5 Hrs.**

Introduction & Concepts: Introduction to Internet of Things, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels.

UNIT-2: **6Hrs**

Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style.

UNIT-3: **7Hrs**

M2M & System Management with NETCONF-YANG: M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software defined Networking, Network Function Virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems management with NETCONF-YANG.

UNIT-4: **6Hrs**

Developing Internet of Things & Logical Design using Python: Introduction, IOT Design Methodology, Installing Python, Python Data Types & Data Structures, Control Flow, Functions,

UNIT-5: **6Hrs**

Python Modules, Packages, File Handling, Date/ Time Operations, Classes, Python Packages, Iot Device-Raspberry Pi, Programming Raspberry pi with Python

UNIT-6: **7Hrs**

IoT physical servers and cloud offerings, Introduction to cloud storage models and communication APIs, Python web application frame work-Django, Amezon web service for IoT

New topic to be announced time to time

Text books:				
1	Internet of Things: A Hands-On Approach	1st edition 2015	by Arshdeep Bahga, Vijay Madisetti	Orient Blackswan Private Limited - New Delhi
Reference books:				
1	Designing the Internet of Things	1st edition	By Adrian McEwen	Wiley
2	Python for Everybody		Charles R. Severance	

VI Semester

ET2382- PE II : Lab. Internet of Things (IoT)

Course Learning Objectives	**Course Outcomes**
Students should be able	Students will be able to
1. To understand the physical and Logical design of IoT.	1. Illustrate the physical and Logical design of IoT.
2. To study the M2M and NETCONF.	2. Explain the M2M and NETCONF.
3. To understand python programming.	3. Develop python programs for IoT applications.
4. To understand physical servers and cloud offerings.	4. Design IoT based systems.

Expt. No.	**Name of Experiment**
01	Add ten natural numbers in python
02	Experiment on functions in python
03	Experiment on string manipulation in python
04	Interfacing LED with Raspberry pi.
05	Interfacing DHT11 sensor with Raspberry pi.
06	File handling using Python.
07	Reading data from server.
08	Experiment on python Django.
09	Experiment on python Django.
10	Preparing complete IoT system using AWS server
11	Mini-project

VI Semester
ET2383- PE II : Optical Communication

Course Objectives	Course Outcomes
Students should be able to 1. Learn the principles of step index and graded index optical fiber. 2. Know the types of losses in optical fiber. 3. Understand Transceiver systems in optical communication. 4. Learn concept of active, passive devices and measurements in optical communication.	Students will be able to 1. Elaborate the concepts of optical communication system. 2. Analyze Optical Communication Systems with different types of losses. 3. Select appropriate types of optical fibers and receivers. 4. Elaborate different methods of loss measurements in fiber optics

UNIT I : INTRODUCTION TO OPTICAL FIBERS
Introduction of fiber Optic system. Principle of optical communication-Attributes and structures of various fibers such as step index, graded index mode and multi mode fibers. Propagation in fibers-Ray mode, Numerical aperture and multipath dispersion in step index and graded index fibers structure, Electromagnetic wave equation in step index and graded index fibers ,Modes and Power flow in fibers . **06Hrs**

UNIT II : SIGNAL DEGRADATION IN OPTICAL FIBERS Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides Group Delay – Material Dispersion, Wave guide Dispersion, Intermodal dispersion, Pulse Broadening in GI fibers – Mode Coupling **06Hrs**

UNIT III : 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 – Rate equations – External Quantum efficiency –Laser Diodes structures and radiation patterns – Single Mode lasers – Modulation of Laser Diodes, Fabry Perot cavity Quantum laser **06Hrs**

UNIT IV : FIBER OPTICAL RECEIVERS
PIN and APD diodes – Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise – Comparison of Photo detectors – Fundamental Receiver Operation – pre-amplifiers - Receiver Configuration- The Quantum Limit . **06Hrs**

UNIT V: POWER LAUNCHING AND COUPLING IN DIGITAL TRANSMISSION SYSTEM
Source to fiber power launching –Fiber to Fiber Joints-Fiber Splicing and connectors, Mechanical Misalignment, line coding –error correction- Noise Effects on System Performance , Wavelength division Multiplexing.
06Hrs

UNIT VI: Measurement in optical fibers
Attenuation, Time domain dispersion and Frequency domain dispersion, NA measurement Refractive index profile and optical source characteristic measurements, OTDR, Eye pattern, **New topic to be announced time to time**

06Hrs

VI Semester
ET2383- PE II : Optical Communication

Text books:				
1	Optical Fiber Communication	2008	Gerd Keiser,	McGraw-Hill International,
2	Optical Communication, Principles and Practice.		J.Senior	Prentice Hall of India
Reference books:				
1	Optical Communication System		J. Gower	Prentice Hall of India
2	Fiber-Optic Communication System	Third Edition	GovindAgrawal	John Willy & Sons

VI Semester
ET2384- PE II : Lab. Optical Communication

Course Objectives	Course Outcomes
Students should be able to 1. Learn the principles of step index and graded index optical fiber. 2. Know the types of losses in optical fiber. 3. Understand Transceiver systems in optical communication. 4. Learn concept of active, passive devices and measurements in optical communication.	Students will be able to 1. Elaborate the concepts of optical communication system. 2. Analyze Optical Communication Systems with different types of losses. 3. Select appropriate types of optical fibers and receivers. 4. Elaborate different methods of loss measurements in fiber optics

Sr. No.	Experiments based on
1	Optical analog and digital transmission
2	Numerical Aperture
3	Losses in Fiber optics
4	Optical detector Characteristics
5	Fiber Bandwidth/ Data Rate
6	Optical Sources Characteristics
7	Multiplexing in Optical Fiber
8.	Optical Time domain Reflectrometry. (OTDR)
9.	Voice transmission in optical fiber.
10.	Modulation in Optical fiber.
11	Eye Pattern

VI Semester

ET2385- PE II: Principles of image processing

Course Objective	Course Outcome
Students should be able to 1) Learn the fundamentals of digital image processing algorithms. 2) Learn the algorithms of spatial and frequency domain filtering. 3) Learn segmentation and restoration of digital images through various algorithms 4) Understand the process of image representation and description	Students will be able to 1) Examine the concepts of image enhancement, restoration, segmentation, representation and description. 2) Apply basic image processing algorithms and filtering techniques for image enhancement. 3) Apply the algorithms for image restoration and segmentation 4) Extract the features for image representation and description

UNIT I: Digital Image fundamental

Digital Image fundamental steps and components of an image processing system, elements of visual perception, Image formation and acquisition, Image sampling and quantization, some basic relationship between the pixels, mathematical tools used in digital image processing. **06Hrs**

UNIT II: Intensity Transformation and Histogram Processing

Image Negative, Log Transformation, Power Law transformation, Linear Piecewise transformation, Histogram Equalization, Histogram Specification, Histogram Statistics **06Hrs**

UNIT III: Filtering in spatial and frequency domain

Fundamentals of Spatial Filtering, Smoothing spatial filtering, Sharpening Spatial Filtering, Unsharp masking and High boost filtering, filtering in Frequency Domain: Introduction to Fourier transform and frequency domain, Smoothing frequency domain filters, and sharpening frequency domain filters **06Hrs**

UNIT IV: Image Restoration

Image Restoration Image degradation/restoration process, noise model, restoration in presence of noise, periodic noise reduction, linear, position invariant degradation, estimating degradation function, Inverse filtering, Wiener filtering **06Hrs**

UNIT V : Image Segmentation

Fundamentals, Detection of discontinuities: Point, Line and Edge, Thresholding, Region based segmentation: Region Growing, Split and Merge, Clustering

06Hrs

UNIT VI : Feature Extraction

Boundary Pre-processing: Chain Code, MPP, Signatures, Skeleton; Boundary Descriptors: Simple Descriptor, Shape Number, Fourier Descriptor, Statistical Moments; Region Feature descriptor: Basic descriptor, Topological Descriptor, Texture Descriptor **06Hrs**

Text books:				
1	Digital Image Processing	2nd edition 2002	R.C. Gonzalez & R.E. Woods	Addison Wesley/Pearson education publication
2	Fundamentals of Digital Image processing	2nd edition.	A. K. Jain	PHI publication
Reference books:				
1	Digital Image processing using MATLAB	2004	R.C. Gonzalez & R.E. Woods	Addison Wesley/Pearson education publication
2	Digital Image processing	3rd Edition 2004	William K. Pratt	John Wiley

VI Semester
ET2386- PE II: Lab. Principles of image processing

Course Objective	**Course Outcome**
Students should be able to 1) Learn the fundamentals of digital image processing algorithms. 2) Learn the algorithms of spatial and frequency domain filtering. 3) Learn segmentation and restoration of digital images through various algorithms 4) Understand the process of image representation and description	Students will be able to 1) Examine the concepts of image enhancement, restoration, segmentation, representation and description. 2) Apply basic image processing algorithms and filtering techniques for image enhancement. 3) Apply the algorithms for image restoration and segmentation 4) Extract the features for image representation and description

Sr. No.	Experiments are based on
1	Basic Operations on Digital Images
2	Image enhancement using Gray level Transformation
3	Image Enhancement Using Piecewise linear transformation
4	Image Enhancement Using Histogram Processing
5	Spatial Domain Filtering Techniques for Image Enhancement
6	Frequency Domain Filtering Techniques for Image Enhancement
7	Noise modeling and Basic Restoration Techniques
8	Image Segmentation
9	Image Compression
10	Image Representation and Description

VI Semester

ET2387- PE II: TV & Video Engineering

Course Objectives	Course Outcomes
Students should be able to	Students will be able to
1. Introduce the basic principles of T.V. 2. Study different television systems and standards 3. Learn to elaborate video amplifiers and luminance channel. 4. Explore different types of color T. V. receivers. 5. Describe cable television and video disc-recording and playback. 6. Study digital television-transmission and reception.	1. Describe basic concept of monochrome and color TV. 2. Describe and troubleshoot Video Amplifier & luminance circuits. 3. Explain and compare PAL, NTSC and SECAM systems. 4. Explain and compare analog and digital television-transmission and reception.

UNIT-1: COLOUR SIGNAL GENERATION AND ENCODING:

Introduction monochrom T V system ,Colour TV camera , Desired Composition of Video Signal, Freq. interleaving, PAL colour TV standards ,Luminance Signal (Y),,Colour Difference Signals, Encoding of Colour Difference Signals, generation of U and V signals, PAL Encoder, Chrominance Signal for Colour Bar Pattern, colour TV Transmitter Block diagram **06 Hrs**

UNIT-2:TELEVISION SYSTEMS AND STANDARS:

NTSC Colour T V standards, generation of I and Q signals, NTSC encoder, NTSC colour T V system ,SECAM colour TV standards, ,Transmission of colour difference signal in SECAM system, SECAM encoder SECAM colour TV system .

06Hrs

UNIT-3VIDEO AMPLIFIERS AND LUMINANCE CHANNEL

Desired Composition of colour Video Signal, Video Amplifier, Problems of DC Coupling, Consequences of AC Coupling, DC Reinsertion, Contrast and Brightness Control Methods, Video Amplifier Circuits Luminance or Y Channel, Trouble shooting Video Amplifier circuits

06Hrs

UNIT-4: COLOUR TELEVISION RECEIVERS

PAL-D Decoder, Separation of U and V Signals, U and V demodulators Colour Burst Separation, Colour Killer Circuits, Colour Signal Matrixing, PAL Colour RGB Drive Amplifiers, Sync Separation, Noise in Sync Pulses, Separation of Frame (Vertical) and Line (Horizontal) Sync Pulses, NTSC decoder, SECAM decoder.

06Hrs

UNIT-5:CABLE TELEVISION, VIDEO DISC-RECORDING

Cable Signal Sources, Cable Signal Processing, Cable Signal Distribution, Bi -Directional Networks, Scrambling of TV Signals, Cable Signal Converters, Disc Recording and Playback Technology, Single layer and multilayer Discs, DVD Player.

06Hrs

UNIT-6:DIGITAL TELEVISION-TRANSMISSION AND RECEPTION

Digital System Hardware, Signal Quantization and Encoding, Digital Satellite Television, Direct-to-Home Satellite Television, Digital TV Receiver, Merits of Digital TV Receivers, Extended Definition Television (EDTV),High Definition Television (HDTV), LCD Technology, LCD Matrix Types and Operation

06 Hrs

VI Semester
ET2387- PE II: TV & Video Engineering

Text books:				
1	Modern Television Practice, Principles and Servicing	3rd edition Publishing Date : 2010	by R.R. Gulati	New Age International Publishers, Delhi.
2	Television and Video Engineering	2nd Edition MAY-2001	Dhake.A.M	Tata McGraw-Hill
Reference books:				
1	Basic television and video systems	2nd Edition PublishingDate :1999	Grob. B, Herndon. C.E	McGraw-Hill,

VI Semester
ET2388- PE II : Lab. TV & Video Engineering

Course Objective	**Course Outcome**
Students should be able to 1. Learn the fundamentals of digital image processing algorithms. 2. Learn the algorithms of spatial and frequency domain filtering. 3. Learn segmentation, restoration and compression of digital images through various algorithms 4. Understand the process of image representation and description	Students will be able to 1. Examine the concepts of image enhancement, , restoration, segmentation, representation and description. 2. Apply basic image processing algorithms and filtering techniques for image enhancement. 3. Apply the algorithms for image restoration , compression and segmentation 4. Apply the techniques for image representation and description

Expt. No.	Experiments based on
1	To study block diagram of CTV Receiver.
2	To study in detail, circuit of RF tuner section through various test points and step-by-step fault finding.
3	To observe the composite video signal at the output of VIF section
4	To study in detail, circuit of SIF and VIF section through various test points, and step-by-step fault finding.
5	To study the Horizontal oscillator section through various test points and step-by-step fault finding.
6	To study the Vertical oscillator section through various test points and step-by-step fault finding.
7	To study the detail circuit of video and chroma section through various test points and step-by-step Faultfinding.
8	To study in details, of audio section through various test points
9	To study power supply section through various test points.
10	To study CCVS signal for color bar pattern using pattern generator.
11	To study the chrominance signal, which represents colour saturation and Hue of a scene or picture.

VI Semester

ET 2391- OE III: MICROCONTROLLER & EMBEDDED SYSTEMS

Course Learning Objectives	Course Outcomes
The student should be able to 1) To understand the architecture and pin functions of 8 bit microcontroller. 2) To study the assembly language instruction set. 3) To understand programming microcontroller in C language. 4) To understand interfacing of on and off chip peripherals with 8051 microcontrollers	**The student will be able to** 1) Elaborate 8051 microcontroller architecture. 2) Develop assembly and embedded C language program. 3) Interface 8051 microcontroller with different peripherals 4) Examine Arduino architecture

Unit No.	Contents	Max. Hrs.
1	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	6
2	Addressing modes, Instruction set and Assembly language programming Programs using look up table, Bit manipulation, 8051 I/O programming, Delay Programs.	6
3	I/O Interfacing such as LED, switches, 7segment display, keyboard matrix programming, 8051 programming in C: Data types and time delay, I/O programming, Logic operations, Data conversion programs, Lookup table access	6
4	Timer programming in assembly and C: Various modes of operation, SFR related to timer operation. Serial Port programming in assembly and C: Basics of serial communication, 8051 connection to RS 232. Serial data transfer programs.	6
5	Interfacing of LCD, ADC, DAC, stepper motor and DC motor with 8051 microcontroller	6
6	Block diagram of Arduino, features of Arduino Architecture, Arduino pin description: digital pins, analog pins, Power pins and other pins, Interfacing of LED, 7-Segment display, LCD, Sensors, DC motor, switch and Serial communication. New topic to be announced time to time .	6

VI Semester
ET 2391- OE III: MICROCONTROLLER & EMBEDDED SYSTEMS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	The 8051 Microcontroller and Embedded systems using assembly & C	2nd edition	by Muhammad Ali Mazidi	Pearson Education Asia LPE
2	Programming and Customizing the 8051 Microcontroller		By MykePredko	McGraw-Hill
3	The 8051 Microcontroller	3rd edition	By Kenneth Ayala	CENGAGE Learning
4	Arduino Development Cookbook		Cornel Amariei	PACKT Publishing

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets	Douglas V Hall	Tata McGraw Hill	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets
2	Microprocessor & Interfacing	A. K. Ray, K. M. Bhurchandi.	Tata McGraw Hill	Microprocessor & Interfacing

VI Semester

ET 2392–OE III: PRINCIPLES OF COMMUNICATION ENGINEERING

Course Learning Objectives	Course Outcomes
The student should be able to 1) Understand various modulation and demodulation techniques of analog and digital modulation. 2) Describe and determine the performance of different error control coding schemes for the reliable transmission of digital representation of signals and information over the channel. 3) Understand various multiple access techniques in wire and wireless communication 4) To learn the basic of satellite communication and elements of optical fiber transmission	**The student will be able to** 1. Describe analog and digital communication systems and various modulation schemes. 2. Analyze error correcting codes, including block codes. 3. Illustrate multiple access techniques in wired and wireless communication. 4. Discuss the different applications of satellite communication and optical communications

Unit No.	Contents	Max. Hrs.
1	**ANALOG COMMUNICATION** Introduction to Communication Systems; Noise, Types of noise, sources of noise; Need for modulation, AM-Time domain representation, Frequency spectrum, power relations, DSB/SC, SSB Angle modulation**.**	6
2	**DIGITAL COMMUNICATION** Introduction Digital Communication System; Pulse modulations – concepts of sampling and sampling theorems, PAM, PWM, PPM; Waveform coding Techniques: Pulse code Modulation (PCM), Delta Modulation, Adaptive Delta modulation.	6
3	**Digital Modulation** Data formats; Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Phase Shift Keying (PSK) – BPSK – QPSK– Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM ; Bandwidth Efficiency; Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).	6
4	**SOURCE CODES, LINE CODES & ERROR CONTROL** Entropy, Properties of entropy; source coding: Huffman coding**;** error control codes and applications: convolutions & block codes.	6
5	**MULTIPLE ACCESS TECHNIQUES** FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages (merits)	6
6	**SATELLITE, OPTICAL FIBER – POWERLINE, SCADA** types of satellites , frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite – Intelsat and Insat; fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications SCADA**,** New topic to be announced time to time	6

VI Semester

ET 2392–OE III: PRINCIPLES OF COMMUNICATION ENGINEERING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Principles of Communication Systems	2007	Taub &Schiling	Tata McGraw Hill
2	Principles of Digital Communication	1986	J.Das	New Age International

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Electronic Communication Systems	4th Edition, 1993	Kennedy and Davis	Tata McGraw hill
2	Digital Communication Fundamentals and Applications	2001	Sklar	Pearson Education
3	Digital Communication	2004.	Bary le, Memuschmidt	Kluwer Publication

VI Semester

ET 2393–OE III: FUNDAMENTALS OF IMAGE PROCESSING

Course Learning Objectives	Course Outcomes
The student should be able to 1) Learn the fundamentals of digital image processing algorithms. 2) Learn the algorithms of spatial and frequency domain filtering. 3) Learn segmentation of digital images through various algorithms 4) Learn representation and recognition of digital images through various algorithms	**The student will be able to** 1) Examine the concepts of image enhancement, segmentation, representation and recognition 2) Apply basic image processing algorithms and filtering techniques for image enhancement. 3) Apply the algorithms for image segmentation 4) Apply the techniques for image representation and recognition

Unit No.	Contents	Max. Hrs.
1	**Introduction** Origin of Digital Image processing, Fundamental Steps in image processing, Component of Image processing system, Sampling and quantization, Interpolation Techniques, Geometric transformation, Concept of gray levels, Relationship between pixels, Applications of Image Processing.	6
2	**Intensity Transformations** Background, Basic intensity transformation techniques: Image negative, log transformation, power law transformation, piecewise linear transformation, Histogram processing: Histogram Equalization, Histogram Matching, Local histogram processing.	6
3	**Spatial and Frequency Domain Filtering** Mechanics of Spatial filtering, Smoothing spatial filters: Linear and Order statistic filters, Sharpening filters: Foundation, Laplacian and Gradient, Filtering in frequency domain	6
4	**Image Segmentation** Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region based segmentation.	6
5	**Representation and Description** Representation, Boundary Descriptors, Regional Descriptor	6
6	**Object Recognition** Patterns and Pattern Classes, Recognition based on decision Theoretic Methods, Structural Methods, **New topic to be announced time to time**	6

VI Semester

ET 2393–OE III: FUNDAMENTALS OF IMAGE PROCESSING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Digital Image Processing	2nd edition	R.C. Gonzalez & R.E. Woods	Addison Wesley/Pearson education publication 2002.
2	Digital Image Processing	4th edition	William K. Pratt	A John Wiley & Sons, Inc., Publication

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Digital Image Processing		Anil K. Jain	PHI
2	Digital Image Processing		S. Jayaraman, S. sakkirajan, T Veerakumar	McGraw-Hill

VI Semester

ET 2396–OE IV: SOFT COMPUTING

Course Learning Objectives	Course Outcomes
The student should be able to 1) Familiarize with soft computing concepts. 2) Learn the concepts of Genetic algorithm 3) Learn the concepts of Fuzzy Logic and Neural networks	**The student will be able to** 1) Examine genetic algorithms, fuzzy logic and neural network techniques 2) Apply genetic operators and genetic algorithms for problem solving 3) Apply Neural Network algorithms in pattern recognition 4) Apply fuzzy logic to solve engineering problems

Unit No.	Contents	Max. Hrs.
1	**Genetic Algorithm** Basic terminologies used in Genetic Algorithm, Simple GA, General Genetic Algorithm, Encoding, Selection, Crossover, Mutation, Stopping Condition for GA, Constraint in GA	6
2	**Neural Networks** Biological Neurons and Their Artificial Models, Models of Artificial Neural Networks, Learning Methods, Activation Functions, McCulloch-Pitts Neuron Model, Neural Network Learning Rules, Application of NN	6
3	**Supervised Learning** Single Layer Perceptron, Back propagation algorithm, Associative Memory.	6
4	**Unsupervised Learning** Hamming and Max net, Competitive Learning, self-organizing feature maps, ART Networks, RBF	6
5	**Fuzzy Sets and Operations** Concepts of Fuzzy sets, extension principle Operation on fuzzy sets, Fuzzy numbers, arithmetic operations, Lattice, fuzzy equations	6
6	**Fuzzy logic and Systems** Fuzzy relations Fuzzy Logic, Approximate Reasoning, Fuzzy controllers, Defuzzification Methods, Fuzzy Inference Techniques, Applications, **New topic to be announced time to time**	6

VI Semester

ET 2396–OE IV: SOFT COMPUTING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fuzzy sets and Fuzzy logic	1995	By George Klir, Bo Yuan	PHI
2	Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications	2003	By S. Rajsekharan, VijayalaxmiPai	PHI
3	Elements of Artificial Neural Network	1997	By K. Mehrotra	MIT Cognet

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Neural Networks, a comprehensive foundation	1999	By Simon Haykins	PHI
2	Artificial Neural Networks	2004	By B. Yegnanarayana	PHI
3	Fuzzy Logic & Applications	2003	By T. Ross	McGraw Hill
4	Soft Computing,	2011	Sivanandanam and Deepa	Wiley

VI Semester

ET 2397–OE IV: INDUSTRIAL INSTRUMENTATION

Course Learning Objectives	Course Outcomes
The student should be able to 1) Study the characteristics of Instruments. 2) Understand the Concepts of Pressure measurements and its calibration process 3) Understand the working principle of various active &passive temperature transducers. 4) Learn the working principle of various flow transducers. 5) Learn the working principle of various transducers like level, thickness speed, ph value etc. 6) Learn automation system components.	**The student will be able to** 1) Explain instrumentation system 2) Analyze pressure, temperature, parameters measured using transducers 3) Analyze flow, speed and level parameters measured using transducers 4) Elaborate automation system components.

Unit No.	Contents	Max. Hrs.
1	**INTRODUCTION** Block diagram of instrumentation system, static and dynamic characteristics of instruments, functions of instruments, Definition of Transducers- Role of transducers in instrumentation- Advantages of electrical transducers – Classification of transducers- Analog and Digital, Active and passive, Primary and Secondary transducers- Inverse transducer-Sensitivity and specification for transducers - Characteristics and Choice of transducer-Factors influencing choice of transducer. Need of transducers, Classification, selection criteria. Calibration Process.	6
2	**PRESSURE MEASUREMENT** Units of pressure - Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – Diaphragms– Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezoresistive pressure sensor –Testing and calibration of pressure gauges – Dead weight tester.	6
3	**TEMPARATURE MEASUREMENT 1** Different types of filled in system thermometer , Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics – Three lead and four lead RTDs.	6
4	**TEMPARATURE MEASUREMENT2: THERMOCOUPLES AND PYROMETERS** Thermocouples – Laws of thermocouple – Signal conditioning of thermocouples output –cold junction compensation –Response of thermocouple, Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two color radiation pyrometers.	6
5	**FLOWMETERS** Variable head type flow meters: – Orifice plate – Venturi tube – Pitot tube. Area flow meter: – Rotameter, Principle and constructional details of electromagnetic flow meter – Ultrasonic flowmeters flow measurements for gases	6
6	**MISCELLANEOUS MEASUREMENT** Electrical level gauge: – Resistive , Ultrasonic type, Radar type ,Speed measurement -D.C and A.C Tacho generators ,rotary encoder, Proximity sensors- Inductive and capacitive, Introduction to PLC, SCADA. **New topic to be announced time to time**	6

VI Semester

ET 2397–OE IV: INDUSTRIAL INSTRUMENTATION

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Industrial Instrumentation and Control	2003	S.K. Singh	Tata McGraw Hill, 2003.
2	Transducers and Instrumentation		D V S Murthy	prentice Hall of India Pvt. Ltd., New Delhi
3	Electrical and Electronic Measurements AND Instrumentation		A. K. Sawhney	Dhanpat Rai &Co

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Principles of Industrial Instrumentation ata		D. Patranabis T	McGraw Hill Publishing Company Ltd, 1996.
2	Programming for Industrial Automation		Kevin Collins	
3	Instrumentation Measurement & Analysis	2004.	B.C. Nakra & K.K.Chaudary	Tata McGraw Hill Publishing Ltd
4	Measurement Systems – Application and Design	2003	E.O. Doebelin	Tata McGraw Hill publishing company
5	Industrial Instrumentation		D.P. Eckman	Wiley Eastern Ltd.

VI Semester

ET 2398–OE IV: MEDICAL ELECTRONICS

Course Learning Objectives	Course Outcomes
The student should be able to 1) Know the physiology of heart , brain and skin, Understand the basic principles of physical parameters 2) Comprehend the working principles of measuring, monitoring and recording instruments. 3) Know the physical concepts of radiography related to X rays 4) Learn working principles of advanced medical imaging system	**The student will be able to** 1) Elaborate basic physiological systems of human body 2) Explain the physiological parameter measurement techniques. 3) Explain the working of measuring and recording instruments for physiological parameters. 4) Elaborate the working principles of modern imaging systems

Unit No.	Contents	Max. Hrs.
1	Cell as bio electric generator: Introduction of man instrumentation system, Heart and Circulatory system, Components of man instrumentation system , Brain and nervous system, Physiological system of the body.	6
2	**Physiological parameter Measurement:** Blood pressure and Flow, Heart rate and Heart sounds, Characteristics of blood flow, Respiration and Temperature	6
3	**Recording Instrumentation:** Electrodes, basic instrumentation, Electrocardiograph, Electroencephalograph, ,Electromyograph, Phonocardiograph	6
4	**Measuring Instrumentation:** Transducers, Blood Pressure, Blood flow and Pulse oximeters, Heart rate respiration rate and temperature meters, Audiometer and hearing Aid	6
5	**X-rays:** X-ray Physics, Fluoroscopy and radiography, X-ray tubes and X-ray Equipments, Biomedical computer application	6
6	**Advanced Imaging System:** Ultrasonic scanner, CT scan, MRI, Endoscope and Measurement of blood flow and cardiac Output **New topic to be announced time to time**	6

VI Semester

ET 2398–OE IV: MEDICAL ELECTRONICS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Medical Electronics	2003	Patil A. G	ISTE Excel book
2	Biomedical Instrumentation and Measurements	Second edition 2004	Leslie Cromweel, Fred J. Weibell, Erich A.	PHI

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Handbook of Biomedical Instrumentation	New Delhi, 2003.	Khandpur, R.S	TATA McGraw Hill
2	Introduction to Biomedical equipment Technology	New York,2004	Joseph J.Carr and John M.Brown	John Wiley and Sons

VI Semester

ET 2399–OE IV: DISPLAY TECHNOLOGY & APPLICATIONS

Course Learning Objectives	Course Outcomes
The student should be able to 1) To learn fundamental concepts of different display technologies related to manufacturing techniques and materials used for FPD selection. 2) To explore electrical, optical and physical specifications required for display technologies 3) To understand different displays and addressing of displays 4) To learn backplane technology and driver integration 5) To identify and comprehend materials and applications of display	**The student will be able to** 1) Identify different display technologies and manufacturing process. 2) Analyze characteristics of display devices and Luminescence materials. 3) Analyze addressing matrix, TFT backplane and backlight unit technologies. 4) Elaborate advanced display devices and Materials .

Unit No.	Contents	Max. Hrs.
1	Overview of display technologies, emmisive-nonemmisive displays, information capacity of displays, introduction to different flat panel display technologies, Display specifications, display manufacturing process overview	6
2	Characterization and performance of displays: Concepts of aspect ratio, color gamut, contrast and gradation, directional visibility, memory and storage, resolution, addressability, Fundamentals of Photometry, Colorimetry, CIE colorimetry	6
3	Luminescence and luminescent materials: Physical processes and interactions leading to emission of light, Mechanisms of Electron and Hole Recombination in Semiconductors, Recombination Rates of Excess Carriers and Excess-Carrier Lifetimes, Basics of matrix addressing of displays: active and passive matrix.	6
4	Technical discussion of display technologies: TFT, LEDs, OLEDs, LCDs, Active matrix TFT backplanes for OLED and LCD displays. Other displays and associated technologies.	6
5	Advanced TFT Backplane Technologies (IGZO, LTPS, etc.) and Driver Integration. Back Light Unit Technologies (CCFL, LED, QD, etc.)	6
6	Future and New Applications of Displays. Materials for Display – TFT, EL and LC Materials and Modes New topic to be announced time to time	6

VI Semester

ET 2399–OE IV: DISPLAY TECHNOLOGY & APPLICATIONS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Flat Panel Displays	2008	Jiun-Haw Lee, David N. Liu, Shin-Tson Wu	Wiley publications
2	Fundamentals of Solid-State Lighting: LEDs, OLEDs, and Their Applications in Illumination and Displays	2014	Vinod Kumar Khanna	CRC press

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Liquid crystal displays: fundamental physics and technology.	2011	R. H. Chen	John Wiley and Sons
2	Liquid crystal flat panel displays: manufacturing science & technology.	2012	W. Mara	Springer, Science & Business Media,

VI Semester

ET2400–OE IV: PLCs and SCADA

Course Learning Objectives	Course Outcomes
Students should be able to 1) Understand the fundamentals of Automation and their applications, systems used in industry such as PLC, Memory devices, Input /Output system and Relays. 2) Learn PLC and SCADA programs for industrial automation. 3) Understand the concepts of HMI & SCADA 4) Understand the concepts in distributed control systems	**Students will be able to** 1) Explain the basic building blocks of Programmable logic controller 2) Develop PLC and SCADA programs for industrial automation. 3) Illustrate the concepts involved in HMI & SCADA 4) Elaborate the concepts in distributed control systems

Unit No.	Contents	Max. Hrs.
1	**Introduction to Programmable Controllers** Definition , A Historical Background , Principles of Operation , PLCs Versus Other Types of Controls , PLC Product Application Ranges, Advantages of PLCs, PLC Sizes and Scopes of Applications, Overview of PLC System	6
2	**Introduction to Programming Languages** Types of PLC Languages, Ladder Diagram Format, Ladder Relay Instructions, Ladder Relay Programming, IEC 1131-3 Programming Languages – FBD/ST/IL/SFC **Programming Instructions** NO-NC & coil based instructions (Relay based Instructions), Timers, Counters, Compare, Mathematics, Jump and Subroutines	6
3	**Introduction to SCADA** Introduction and brief history of SCADA, Fundamental principles of modern SCADA systems, the components of a SCADA system, Types of SCADA **SCADA Programming** Graphics Building & Simulation, Tag types & Management, Tools, Programming techniques, Alarms & Trends Configuration, Screen Navigation	6
4	**Introduction to HMI** FOUNDATIONS OF HMI: The Human: History of User Interface Designing, Types, Features, General architecture , Conventional & current HMI systems, Difference between HMI & SCADA, HMI Hardware interfaces, Practical uses in Industries.	6
5	**Data comparison instructions & PLC sequencers** Data comparison instructions such as EQU, LES, and GRT, Introduction to the principles of Data Transfer, Move Instruction, Introduction to Shift Registers & Its types. Purpose and application of PLC Sequencers, Masking techniques and the various types of Sequencers, SQO and SQC instructions.	6
6	**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.	6

VI Semester
ET2400–OE IV: PLCs and SCADA

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Programmable Logic controllers		Gary Duning	Delmar Thomson Learning
2	SCADA: Supervisory Control and Data Acquisition	Fourth Edition	Stuart A Boyer	ISA 1999
3.	Programmable Logic Controllers	Fifth Edition	Frank Petruzella	McGraw-Hill Education

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Programmable logic controller		W. Bolton	Elsevier Publisher

(07 Hours)

VII Semester
ET 2401–RF & Microwave

Text books:				
1	Microwave Devices and Circuits	Samuel Y. Liao	3rd edition	Pearson Education
2	Foundations for Microwave Engineering	Robert E. Collin	2nd edition	McGraw Hill

Reference books:				
1	Microwave Engineering	Annapurna Das, Sisir K. Das		McGraw Hill

VII Semester
ET 2402 – Lab: RF & Microwave

Course Objectives	Course Outcomes
Students should be able to 1) Know various resonant and non-resonant microwave power generators. 2) Study the concept of scattering matrix. 3) Understand working of various microwave passive devices 4) Know the various microwave measurement techniques. 5) Learn the working principle of microwave solid state devices	Students will be able to 1) Analyze the behavior of linear beam and cross field tubes. 2) Apply s-parameters to model and analyze output response of microwave transmission lines. 3) Analyze behavior of different passive components using s-matrix. 4) Measure performance parameters of microwave devices. 5) Explore various microwave solid state devices.

Expt. No.	Name of Experiment	COs
1.	To determine frequency of reflex klystron & determine its electronic tuning range	CO1
2.	To verify power Vsrepellar voltage characteristics of Reflex Klystron.	CO1
3.	To verify frequency Vsrepellar voltage characteristics of Reflex Klystron.	CO1
4.	To verify performance of waveguide tees- E-Plane tee & H-plane Tee.	CO3
5.	To verify performance of E-H plane tee (Magic Tee)	CO3
6.	To verify performance of Directional Coupler.	CO3
7.	To verify performance of Cross-hole Coupler.	CO3
8.	To verify performance of 3-port circulator	CO3
9.	To verify performance of isolator.	CO3
10.	To find relationship between Cut-off wavelength, free space wavelength & guide wavelength using slotted line section	CO 4
11.	To verify V-I characteristics of Gunn diode.	CO 5

VII Semester
ET2403 – Digital Communication

Course Objectives	Course Outcomes
Students should be able to 1) Understand various source coding techniques. 2) Understand signal space concepts. 3) Understand the key modules of digital communication systems with emphasis on digital modulation techniques. 4) Learn different channel coding techniques 5) Understand the concept of spread spectrum modulation, its types and applications.	Students will be able to 1) Analyze various source coding techniques. 2) Illustrate signal space concepts. 3) Elaborate digital modulation techniques. 4) Analyze different channel coding techniques 5) Apply spread spectrum modulation for various applications of communication systems.

UNIT-1 Analog source coding
Review of Random variables, PDFs & CDFs, Central limit Theorem. Model of digital communication system, PCM, DM, ADM, ADPCM, sub-band and transform coding, model based speech coding like LP coding, CELP coding. **(06 Hours)**

UNIT-2: Digital source coding
Introduction to information theory, channel capacity, Huffman, L-Z encoding algorithm. Rate distortion theory for optimum quantization. **(06 Hours)**

UNIT-3: signal space concept
Gram-Schmitt procedure, Signal space representation of modulated signals, Error probability and optimum receivers for AWGN channels, Matched filters. **(06 Hours)**

UNIT 4: Digital modulation methods
PSK, FSK, QPSK, MSK, GMSK, MPSK, OFDM **(06 Hours)**

Unit 5: channel coding techniques
Introduction to Galois field, Construction of Galois field GF (2 m) & its basic properties. Review of channel coding, Linear block codes, cyclic codes, convolution, encoding and decoding, distance properties, Viterbi algorithm Turbo code, Reed Solomon code **(06 Hours)**

Unit 6: Spread Spectrum

Study of PN sequences, direct sequence methods, Frequency hop methods, digital spread spectrum, slow and fast frequency hop, synchronization methods for spread spectrum, application of spread spectrum

(06 Hours)

VII Semester
ET2403 – Digital Communication

Text books:				
1.	Digital communication	4th edition Date:2005	John G Prokis	TMG
2.	Digital communication	3rd edition August 2007	Simon Haykin	WEP

Reference books:				
1.	Modern Communication systems (Principles and application)	1st edition Publication: 1994	Leon W. Couch II	PHI
2.	Digital Communication	1st edition.	Shanmugham	CBS Publisher
3.	Modern Digital & Analog Communication Systems	4th edition Date: 2009	B.P.Lathi	Oxford Univ Pr Publication
4.	Principles of Communication Systems	2nd edition Pub Date: SEP-07	Taub Schilling	Publisher: Prentice Hall

VII Semester
ET2404 – Lab: Digital Communication

Course Objectives	Course Outcomes
Students should be able to 1) Understand various source coding techniques. 2) Understand signal space concepts. 3) Understand the key modules of digital communication systems with emphasis on digital modulation techniques. 4) Learn different channel coding techniques 5) Understand the concept of spread spectrum modulation, its types and applications.	Students will be able to 1) Analyze various source coding techniques. 2) Illustrate signal space concepts. 3) Elaborate digital modulation techniques. 4) Analyze different channel coding techniques 5) Apply spread spectrum modulation for various applications of communication systems.

Expt. No.	Name of Experiment
1.	Sampling & reconstruction
2.	Linear PCM system
3.	Differential PCM system
4.	Delta Modulation system
5.	Adaptive Delta Modulation system
6.	Companded PCM (A law & μ law)
7.	Data formatting
8.	Shift Keying Techniques- ASK & FSK
9.	QPSK & BPSK

VII Semester
ET 2411 – PE III: Power Electronics

Course Objectives	Course Outcomes
Students should be able to 1) Understand the characteristics of different power electronics switches and selection of components for different applications, 2) Learn different types of power devices 3) Understand the switching behaviour of power electronics circuits such as DC/DC converters. 4) Learn the role of different type of inverters.	Students will be able to 1) Design circuits using power semiconductor devices. 2) Analyze AC/DC , DC/DC and DC/AC and Cyclo-converters. 3) Design of Gate Drive and snubber circuits for SCR 4) Elaborate AC ,DC drives and SMPS

UNIT I: Power semiconductor devices (part A)
Power Semiconductor Diodes, classification, reverse recovery Characteristics, series and shunt connection of power diodes, Power Transistors, Switching characteristics of power transistor, Base drive control. **06Hrs**

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UNIT II: Power semiconductor devices (part B)

Power MOSFETs, IGBT, Silicon controlled rectifier(SCR), dynamic Turn ON and Turn OFF characteristics of SCR, Diac, Triac **06Hrs**

UNIT III: AC –DC Converter
Commutation methods of SCR, Single phase half wave and full wave Controlled Rectifier with resistive and inductive load, **06Hrs**

UNIT IV: DC-DC Converters (Chopper**)** Step up, step down Choppers, design of choppers AC Voltage Controllers. Principle of ON-OFF control, Phase control, single phase cyclo- converter **06Hrs**

UNIT V: DC –AC Converter
Inverters—Series resonant inverters, Modified series inverter, parallel inverter, single phase bride inverter, current source inverter, three phase bridge Inverter: 120 degree and 180 degree mode, design of inverter. Applications

06Hrs

UNIT VI:
Solar converter, buck converter, boost converter, Cuk converter, Design of Gate Drive circuits for SCR, SCR protection circuits, design of snubber circuit, Introduction to AC and DC drives. SMPS

06Hrs

VII Semester
ET 2411 – PE III: Power Electronics

Text books:				
1	Power Electronics:Circuits,Devices and Applications	Fourth Edition	Muhammad H. Rashid	Academic press
2	Power Electronics	Second Edition 2008	M. D. Singh,K. B. Khanchandani	TATA McGraw-Hill
3	Industrial and power electronics	Third Edition 2007	Deodatta Y. Shinare	Electrotech Publication
4	Power Electronics and its application	Second Edition, 2004	Alok Jain	Penram International Publishing Pvt Ltd

Reference books:				
1	Power Electronics	Third Edition 2012	Ned Mohan	John Wiley & sons
2	Fundamentals of power electronics	Third Edition 2020	Erickson, Robert W., Maksimovic , Dragan	

VII Semester
ET2412 – PE III: Data compression and encryption

Course Objectives	Course Outcomes
Students should be able to 1) Understand text, audio and video compression techniques. 2) Understand data security issues 3) Understand Symmetric and Asymmetric Key Cryptography schemes. 4) Understand network security.	Students will be able to 1) Elaborate text, audio, image and video compression techniques. 2) Elaborate data and network security issues. 3) Implement text compression Techniques. 4) Implement Symmetric and Asymmetric Key Cryptography schemes.

Unit 1.Introduction to Data Compression

Data Compression : Modelling and Coding, Statstical Modelling, Dictionary Schemes, LZ, Lossy Compression Shannon – Fano Algorithm, Huffman Algorithm, Adaptive Huffman Coding,Difficulties in Huffman Coding, Arithmetic Coding – Decoding, Dictionary Based Compression, Sliding Window Compression: LZ-77, LZ-78, LZW **(6 hours)**

Unit 2. Image Compression

DCT, JPEG, JPEG – LS, Differential Lossless Compression, DPCM, JPEG – 2000 Standards **(6 hours)**

Unit 3.Video and Audio Compression

Analog Video, Digital Video, MPEG – 2, H – 261 Encoder and Decoder Sound, Digital Audio, μ-Law and A-Law Companding, MPEG – 1 Audio Layer (MP3 Audio Format) **(6 hours)**

Unit 4. Data Security

Security Goals, Cryptographic Attacks, Techniques Symmetric Key: Substitution Cipher, Transposition Cipher, Stream and Block Cipher DES, AES **(6 hours)**

Unit 5. Number Theory and Asymmetric Key Cryptography

Prime Numbers, Fermat's and Euler's Theorem, Chinese Remainder Theorem, Discreet Logarithms, Principles of Public Key Crypto System, RSA Key Management, Deffie-Hellman Key Exchange, Message Integrity, Message Authentication and Hash Functions, SHA, H MAC, Digital Signature Standards **(6 hours)**

Unit 6. Network Security

Email, PGP, S/MIME, Intrusion Detection System Web Security Considerations, SSL Architecture, SSL Message Formats, TLS, Secure Electronic Transactions Kerberos, X.509 Authentication Service, Public Key Infrastructure **(6 hours)**

VII Semester
ET2412 – PE III: Data compression and encryption

Text books:				
1	The Data Compression Book	Mark Nelson, Jean-Loup Gailly	2nd edition	BPB Publications
2	Cryptography and Network Security Principles and Practices	William Stallings	5th Edition	Pearson Education.
3	Introduction to Data Compression		2nd edition	Morgan Kaufmann

Reference books:				
1	Cryptography and Network Security, Tata McGraw-Hill.	BehrouzA. Forouzan	2nd edition	Tata McGraw-Hill.

VII Semester
ET 2413 –PE III : Analog VLSI Design

Course Objectives	Course Outcomes
Students should be able to 1) Understand the concept and basics of small signal model of MOS transistor &Perform analysis of single stage amplifiers with or without load 2) Understand small signal parameters of Differential Amplifier. 3) Understand current mirrors as bias element and single stage amplifiers in frequency domain 4) Study Performance parameters of CMOS op amp	Students will be able to 1) Elaborate small and large signal models of MOS transistor amplifiers and ADC, DAC, Sigma-delta converters. 2) Analyze single stage, Differential and operational amplifier circuits. 3) Analyze Performance parameters of ADC, DAC, Sigma-delta converters. 4) Design single stage, Differential and operational amplifier circuits and ADC, DAC, Sigma-delta converters.

UNIT-1 Basic MOS Device Physics

Threshold voltage, Derivation of I/V characteristics, second order effects, MOS device capacitance, MOS small signal models, MOS SPICE models

(06 Hours)

UNIT-2: Single stage amplifiers

Basic concept, common source, common source stage with resistive load, CS stage with source degeneration, source follower, common gate. **(06 Hours)**

UNIT-3: Differential amplifiers

Single ended & differential operation, Basic differential pair, qualitative and quantitative analysis, Common mode response.

(06 Hours)

UNIT 4: Operational amplifiers

Performance parameters, one stage op amp, Gain boosting, Noise in op amp

(06 Hours)

Unit 5: ADC converter and DAC converter

Converting Analog Signals to Digital Signals, Sample-and-Hold (S/H) Characteristics, Digital-to-Analog Converter (DAC) Specifications, Analog-to-Digital Converter (ADC) Specifications. **(06 Hours)**

Unit 6: Sigma Delta Converter

The Oversampling ADC, The First-Order **Sigma Delta** Modulator, The Higher Order **Sigma Delta** Modulators.

(06 Hours)

VII Semester
ET 2413 –PE III : Analog VLSI Design

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

VII Semester
ET 2414 – PE III: Error Correcting Code

Course Objectives	Course Outcomes
Students should be able to 1) Understand the concept and basics of information theory and the basics of source and channel coding/decoding. 2) To understand various mathematical tools: groups and finite fields, Linear algebra in the development of codes and sequences and explain the conventional digital communication system with error control codes like block code, Linear code 3) Understand the properties of error control codes like Cyclic code, BCH code. 4) Understand various error control techniques for Convolutional codes.	Students will be able to 1. Elaborate the various codes for error detection & correction 2. Apply the concepts of information theory for source and channel coding/decoding. 3. Determine error detecting and correcting capability of linear & block codes 4. Analyze error control capability for cyclic, BCH and Convolutional codes.

UNIT-1: CHANNEL CAPACITY AND CODING

Introduction, Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem, The Shannon Limit, Random Selection Of Codes, Hamming Distance, Few Points of Information Theory. **(06 Hours)**

UNIT-2: BLOCK CODES

Coding for reliable digital transmission and storage. Groups, Rings, Vector Spaces, Galois Fields, Polynomial rings The Digital Communication Channel, Introduction To Block Codes, Single Parity Check Codes, Product Codes, Repetition Codes, Hamming Codes, Minimum Distance Of Block Codes, Soft – Decision Decoding, Automatic Repeat Request Schemes **(06 Hours)**

UNIT-3: LINEAR CODES

Definition of Linear Codes, Generator Matrices, The Standard Array, Parity - Check Matrices, Error Syndromes, Error Detection And Correction, Shortened And Extended Linear Codes. **(06 Hours)**

UNIT 4: CYCLIC CODES

Definition Of Cyclic Codes, Polynomials, Generator Polynomials, Encoding Cyclic Codes, Decoding Cyclic Codes, Factors Of XN +1, Parity-Check Polynomials, Dual Cyclic Codes, Generator And Parity-Check Matrices Of Cyclic Codes **(06 Hours)**

Unit 5: BCH CODES

Linear Algebra, Galois Field, Definition and Construction of Binary BCH Codes, Error Syndromes In Finite Fields, Decoding SEC and DEC, Reed- Solomen Codes, LDPC codes **(06 Hours)**

Unit 6: CONVOLUTION CODES

Convolution, Encoding Convolutional Codes, Generator Matrices For Convolutional Codes, Generator Polynomials For Convolutional Codes, Graphical Representation Of Convolutional Codes, The Viterbi Decoder. Concept Of Interleaver And Puncture Coding, Applications of error control coding **(06 Hours)**

VII Semester
ET 2414 – PE III: Error Correcting Code

Text books:				
1	Introduction to Error Control Codes	Gravano Salvatore	1st Ed., 2007.	Oxford University Press,
2	Error Correction Coding Mathematical Methods and Algorithms	Moon Tood K	, 1st Ed., 2006	Wiley- Interscience
3	Digital Communications - Fundamentals and Applications	Sklar Bernard	2nd Ed., 2009.	Pearson Education-LPE,

Reference books:				
1	Information Theory, Coding and Cryptography	Bose Ranjan	, 1st Ed., 2007.	Tata McGraw-Hill
2	Error Control Coding-Fundamentals and Applications	-Shu Lin, Daniel J. Costello		Prentice Hall, Inc.

VII Semester
ET2415– PE III: Wireless Mobile Communication Systems

Prerequisites	Analog and Digital Communications, Digital Signal Processing
Course Objectives Students should be able to 1) Study cellular concepts and techniques to 2) Improve capacity in cellular system and Study fundamentals equalization and diversity technique. 3) Understand mobile radio environment and its different parameters. 4) Learn various multiple access system.. 5) Understand the operating principles of various wireless systems & standards. 6) Learn the fundamentals of GSM & wireless networking.	**Course Outcomes** Students will be able to 1. Analyze Cellular concept and mobile radio propagation 2. Illustrate types of equalization, diversity technique & multiple access techniques for wireless communication. 3. Elaborate concepts of GSM and CDMA 4. Explain wireless networking for mobile communication.

UNIT-1: Introduction to Wireless Communication Systems & Cellular Concept

Evolution of Mobile Radio communication, Cellular telephone system, frequency reuse, channel assignment and handoff strategies, interference and system capacity, trunking and grade of service, improving capacity in cellular system. **(06 Hours)**

UNIT-2: Mobile Radio Propagation

Large & Small Scale Path Loss & Fading: Introduction to Radio Wave Propagation, Reflection, Diffraction, Scattering Practical Link Budget Design Using Path Loss Models Small Scale Multipath Propagation, Parameters of Mobile Multipath Channels, Types of Small Scale Fading, Rayleigh & Rician Distribution. **(06 Hours)**

UNIT-3: Equalization & Diversity

Fundamentals of equalization, Equalizers in communication receiver, Survey of equalizer Technique, space polarization, frequency and time diversity techniques, space diversity, polarization diversity, frequency and time diversity. RAKE Receiver **(06 Hours)**

UNIT 4: Multiple access techniques for wireless communication.

Introduction to Multiple Access, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access, Code Division Multiple Access (COMA), Hybrid Spread Spectrum Techniques, Space Division Multiple Access (SOMA), Packet Radio, Packet Radio Protocols, Carrier Sense Multiple Access (CSMA) Protocols. **(06 Hours)**

UNIT-5: GSM

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), Routers 901, 920 and Switches Case studies on latest Generation **(06 Hours)**

VII Semester
ET2415– PE III: Wireless Mobile Communication Systems

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 signaling, Signaling System No7. An Example of SS7, introduction to various generation of mobile communication. Wi-max Technology, Unlicensed Band Radio (UBR),Case studies on latest wireless data Networks. (**06 Hours)**.

Text books:				
1	Wireless communication Principles and practice	Second edition 5 January 2018	by T S. Rappaport	(Prentice Hall PTR, upper saddle river, New Jersey.)
2	"Modern Wireless Communications" (Indian Edition)	2011	Haykin & Moher	Pearson (Indian Edition)
Reference books:				
1	Wireless digital communication	1995	by Kamilo Feher	PHI
2	Mobile Communications Design fundamentals	1993	by William C. Y. Lee	John Willey
3	Mobile Cellular Communication	2005	by W .C .Y. Lee	Mc Graw Hill
4	Mobile Radio Propagation channel	1996	by J.D. Pearson	John Willey

VII Semester
ET2421 – PE IV: Satellite Communication & Radar Engineering

Course Objectives	Course Outcomes
Students should be able to 1) To understand the satellite system and Propagation on satellite. 2) To understand earth station technology. 3) To make the student understand the principles of Radar and various types of radars 4) To make them understand the RADAR antennas, clutters and Effects of weather on RADAR..	Students will be able to 1) Elaborate satellite services , satellite system and propagation of satellites. 2) Illustrate Earth station technology and tracking of satellites. 3) Analyze the RADAR range equation, Doppler principle and types of radars 4) Elaborate RADAR antennas, Duplexers, clutters and the effects of weather on radar

UNIT-1

Introduction: Origin of Satellite communication, Current state of satellite communication. Orbital aspect of satellite communication: Orbital mechanism, equation of orbit, locating satellite in orbit, orbital elements, and orbital perturbation. Space craft subsystem: Attitude and orbit control system, Telemetry tracking and command power system, and communication subsystem.

(06 Hours)

UNIT-2:

Propagation on satellite: Design aspects of satellite uplink and downlink**,** Earth's path – propagation effects, atmospheric absorption, Scintillation effects, Land and Sea multipath, Rain and ice effects, Rain drop distribution, calculation of attenuation. Rain effects on Antenna noise temperature

(06 Hours)

UNIT-3:

Earth Station technology: Earth Station design; antennas tracking, LNA, HPA, RF multiplexing, factors affecting orbit utilization, tracking, equipment for earth station. Case Study on trends in satellite communication

(06 Hours)

UNIT 4:

RADAR Range Equation, CW and FM modulated RADAR, MTI and Pulse Doppler RADAR, Tracking RADAR.

(06 Hours)

Unit 5:

RADAR antennas, parabolic reflector, scanning field reflector, Lens antennas. Cassegrain reflector, types of feeds, RADAR Receivers, Displays and Duplexer, Detection of RADAR signals in noise, phase array antenna.

(06 Hours)

Unit 6:

RADAR clutter, Effects of weather on RADAR, Detection of targets in Precipitation, Synthetic Aperture RADAR, HF over the Horizon RADAR.

(06 Hours)

VII Semester
ET2421 – PE IV: Satellite Communication & Radar Engineering

Text books:				
1	**Introduction of RADAR system**	Third edition, 2017	**Skolnik**	**McGraw Hill**
2	**Satellite Communication**	Fourth edition, 2017	**Dennis Roddy**	**McGraw-Hill**

Reference books:				
1	Satellite Communications	Kindle Editiion, 2010	Varsha Agrawal Anil	Wiley India Pvt Ltd
2.	Satellite Communication Systems	Second Editions, 1998	M. Richharia	Mcgraw-Hill Telecommunications
3.	Radar Systems Principle	First Edition, 1997	Harold R.Raemer	CRC Press
4.	Satellite Communications	2nd Edition, 2003	Timothy Pratt, Charles Bostian and Jeremy Allnutt,	John Wiley & Sons,

VII Semester
ET2422- PE IV: Embedded System

Course Objectives	Course Outcomes
Students should be able to 1) Study & understand the detailed architectural features of ARM processor. 2) Study instruction set of ARM processor and apply the same for programming 3) Explore the details about LPC 2148 Develop programs in interfacing of different peripherals with NODE MCU ESP8266 4) Understand memory management in ARM and operating system..	Students will be able to 1) Explain the architectural features of ARM processors 2) Apply ARM instruction set for development of assembly language programs. 3) Explain ARM floating point architecture and DSP extensions 4) Apply the knowledge of embedded C to interface Wi-Fi module ESP 8266, ESP32 and Node MCU with various peripherals. 5) Elaborate memory management in ARM and architectural support of operating system.

UNIT-1 Introduction to embedded system and ARM Processor

Difference between RISC & CISC, Advantages of architectural features of ARM Processor, Processor modes, Register Organization, Exceptions and its handling. 3/5- stage pipeline ARM organization. LPC2148 ARM 7 microcontroller, Features of LPC2148, Block diagram of LPC2148. **(06 Hours)**

UNIT-2: Memory and memory-mapped I/Os

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. **(06 Hours)**

UNIT-3: ARM floating point architecture and DSP extensions

ARM floating point architecture and DSP extensions, ARM co-processors. ARM 9 TDMI ARCHITECTURAL STUDY: - H/W architecture, Timing diagrams for various accesses, Memory buses: AMBA, ASB, & APB. Architectural support for system development **(06 Hours)**

UNIT 4: Basic embedded C programs

Basic embedded C programs for GPIO and interfacing of different devices like LED, LCD. Introduction to NODE MCU ESp8266 and ESP 32, NODE MCU ESP8266 Features & Using It with Arduino IDE, NODE MCU ESP8266 Pinout, Power requirement. **(06 Hours)**

VII Semester
ET2422- PE IV: Embedded System

Unit 5: memory Management

Memory Hierarchy, memory size and speed, on-chip memory, caches, cache design, memory management (**06 Hours)**

Unit 6: Architectural Support of Operating System

Introduction of RTOS, RTOS issues, The shared Data Problem, Software Architectures (Round Robin, Round Robin with Interrupts, Function Queue Scheduling,) Selecting a software Architecture, Case for Real Time Operating System, Introduction to RTOS :tasks and task states,tasks and data, semaphores and shared data, message queues, mailboxes and pipes, events, RT Linux. **(06Hours)**

Text books:				
1	ARM System–on-chip Architecture	2nd edition August 25, 2000	by Steve Furber	Pearson Education Asia
2	Embedded Linux, Hardware, Software and interfacing	2nd Edition 2002	by Craig Hallabaugh	Pearson Education Asia
3	Exploring Arduino: Tools and Techniques for Engineering Wizardry 2nd Edition	2nd Edition October 24, 2019	by Jeremy Blum	Wiley; 2 edition (October 24, 2019)

Reference books:				
1	System Developer's Guide: Designing and Optimizing	Publish Date: 2004	Sloss Andrew N, Symes Dominic, Wright Chris	Morgan Kaufman Publication
2	Arduino: A Technical Reference	Publish Date: May 2016	J. M. Hughes	O'Reilly Media, Inc.

VII Semester
ET 2423 – PE IV: Switching Theory

Course Objectives	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) Analyze technology mapping & threshold networks 2) Analyze fault models and testing principles in combinational and sequential circuits 3) Design the synchronous, asynchronous sequential circuits and finite state machines. 4) Analyze behavior of FSM, test generation of sequential circuits, design for testability & BIST through experimentation.

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:

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)

Unit 6

Asynchronous sequential circuits, Modes of operation, Hazards, Synthesis of SIC fundamental-mode circuits.

(06 Hours)

VII Semester
ET 2423 – PE IV: Switching Theory

Text books:				
1	Switching & Finite Automata Theory	Zvi Kohavi, 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 Digital Design	Lee S.C		PHI Edition
2	Digital Logic and Computer Design	M.Morris Mano		PHI Edition

VII Semester
ET 2424 – PE IV: Topics in Machine Learning

Prerequisites	Basic probability and statistics, linear algebra and calculus
Course Objective 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	**Course Outcome** Students will be able to 1) Apply and analyze the model using regression. 2) Apply Supervised and unsupervised learning for problem solving. 3) Apply neural network algorithms for classification. 4) Evaluate deep neural network with computational complexity.

UNIT-1 Regression

Supervised and Unsupervised Learning, Regression, Model and Cost Function, Gradient Descent, Multivariate Linear Regression, Feature Scaling, Gradient Descent for multivariable **(06 Hours)**

UNIT-2: Classification

Classification, Hypothesis Representation, Decision Boundary, Cost function and Gradient Descent, Multi-classification, Regularization, Model Evaluation **(06 Hours)**

UNIT-3: Supervised Learning

KNN, SVM, Decision tree, Naive Bayes Classifiers, Random Forest **(06 Hours)**

UNIT 4: Unsupervised learning

K-means clustering, Hierarchical Clustering, DBSCAN Clustering, PCA, Anomaly Detection, Recommender System (**06 Hours)**

Unit 5: Artificial Neural Network

Introduction to neural network, Activation Functions, Perceptron rule, backpropagation **(06 Hours)**

Unit 6: Deep Learning

Introduction to deep learning, building blocks of CNN, Computational Complexity, case studies based on CNN architectures, **New topics to be announced time to time.** **(06 Hours)**

VII Semester
ET 2424 – PE IV: Topics in Machine Learning

Text books:				
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:				
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

VII Semester
ET 2425 – PE IV: Multimedia Communications

Prerequisites	Basics of digital data and computer networks
Course Objectives Students should be able to 1) Learn the basics of image ,audio representation and transmission 2) Understand basic concepts of image ,audio and video compression 3) Learn basic concepts of multimedia communication networks. 4) Understand basic concepts of Content-Based Retrieval in Digital Libraries	**Course Outcomes** Students will be able to 1) Explain the fundamental concepts of multimedia systems 2) Elaborate image ,audio and video compression techniques 3) Implement Wavelet based image compression and video compression techniques 4) Illustrate various multimedia network protocols 5) Explain concepts of image retrieval from digital libraries

UNIT-1:
Fundamental concepts in Text and Image: Multimedia and hypermedia, World Wide Web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video **(6 hours)**

UNIT-2:
Fundamental concepts in video and digital audio: Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio **(6 hours)**

UNIT-3:
Multimedia data compression: Lossless compression algorithm: DCT, Wavelet- Based Coding, Embedded Zerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT), Basic Audio Compression Techniques **(6 hours)**

UNIT-4:
Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, MPEG2, MPEG4 **(6 hours)**

UNIT-5:
Multimedia Networks: Basics of Multimedia Networks, Multimedia Network Communications and Applications :Quality of Multimedia Data Transmission, Multimedia over IP, RTCP,RTP,SIP Transport of MPEG-4,DMIF, Media-on-Demand(MOD) **,**Multimedia Broadcasting schemes **(6 hours)**

UNIT-6:
Content-Based Retrieval in Digital Libraries C-BIRD— A Case Study ,C-BIRD GUI Color Histogram Color Density Color Layout Texture Layout Search by Illumination Invariance Search by Object Model **(6 hours)**

VII Semester
ET 2425 – PE IV: MultiMedia Communications

Text books:				
1	Fundamentals of Multimedia	Ze-Nian Li , Mark S Drew	2004	PHI/Pearson Education
2	Multimedia Applications	Steinmetz, Nahrst	2004	Springer.

Reference books:				
1	Multimedia Communications: Applications, Networks, Protocols and Standars	Fred Halsall	2001	Addison-Wesley

VII Semester
ET2431-PE V: Display Technology

Course Objective	Course Outcome
Students should be able to 1) To provide the fundamental knowledge for understanding concepts of different display technologies related to manufacturing techniques and materials selection 2) To explore specifications required for display technologies and understand properties of Luminescence materials for different display types. 3) To understand the addressing methods, backplane Technology and Driver Integration part of different new displays. 4) To understand new displays properties of materials modes.	Students will be able to 1) Identify different display technologies and manufacturing process. 2) Analyze characteristics of display devices and Luminescence materials. 3) Analyze addressing matrix, TFT backplane and backlight unit technologies. 4) Elaborate advanced display devices and Materials.

UNIT I :

Overview of display technologies, information capacity of displays, introduction to different flat panel display technologies. LCD Display Internal structure and working, Fundamentals of Photometry,

(06 Hours)

UNIT II :

Characterization and performance of displays: Concepts of aspect ratio, color gamut, contrast and gradation, directional visibility, driving power, efficiency, speed, memory and storage, degradation, resolution, addressability, physiological factors, and measurement instrumentation, Colorimetry, CIE colorimetry

(06 Hours)

UNIT III :

Luminescence and luminescent materials: Physical processes and interactions leading to emission of light, processes responsible for the transfer of energy in luminescent materials, chemistry and preparation of luminescent materials, and emission properties of the prepared materials;

(06 Hours)

UNIT IV:

Basics of matrix addressing of displays: active and passive matrix. Technical discussion of display technologies: LEDs, OLEDs, LCDs, Active matrix TFT backplanes for OLED and LCD displays. Other displays and associated technologies.

(06 Hours)

UNIT V:

Advanced TFT Backplane Technologies (IGZO, LTPS, etc.) and Driver Integration. Back Light Unit Technologies (CCFL, LED, QD, etc.)

(06 Hours)

VII Semester
ET2431-PE V: Display Technology

UNIT VI:

Future and New Applications of Displays. Materials for Display – TFT, EL and LC Materials and Modes

(06 Hours)

Text books:				
1	Liquid crystal flat panel displays: manufacturing science & technology.	W. Mara	2012	Springer, Science & Business Media,
2	Introduction to Flat Panel Displays	Jiun-Haw Lee, David N. Liu, Shin-Tson Wu		Wiley publications

Reference books:				
1.	Liquid crystal displays: fundamental physics and technology.	R. H. Chen	2011	John Wiley and Sons
2.	Fundamentals of Solid-State Lighting: LEDs, OLEDs, and Their Applications in Illumination and Displays	Vinod Kumar Khanna		CRC press

VII Semester
ET2432-PE V: Biomedical Instrumentation

Course Objective	Course Outcome
Students should be able to	Students will be able to
1) Know the physiology of heart and brain , Understand the basic principles of physical parameters	1) Elaborate Fundamentals of Biomedical Instrumentation and its Electrodes
2) Comprehend the working principle of recording instruments signal analysis techniques	2) Explain the measuring and recording instruments
3) Know the concepts of modern imaging systems	3) Describe the functioning of imaging systems.
4) Understand the concept of Therapeutic Equipments	4) Describe the functioning of therapeutic equipment's

UNIT-1: Fundamentals of Biomedical Instrumentation and its Electrodes.

Anatomy and Physiology, Physiological Systems of the Body, Sources of Biomedical Signals, Basic Medical Instrumentation System, Origin of Bioelectric Signals, Recording Electrodes, Electrodes for ECG. Electrodes for EEG, Electrodes for EMG.

(06 Hours)

UNIT-2: Biomedical recorders and its Systems

Basic Recording System, Biomedical Signal Analysis Techniques, Electrocardiograph Phonocardiograph (PCG), Electroencephalograph (EEG), Electromyograph (EMG), Other Biomedical Recorders

(07 Hours)

UNIT-3: Measuring Instrumentation

Blood pressure measurement, Heart sound measurement oximetry, Pulse Oximeter, Electromagnetic Blood Flowmeter, Ultrasonic Blood Flowmeters, Coulters Counters.

(06 Hours)

UNIT 4: Analysers

Pulmonary Function Measurements, Spirometry, Pneumotachometers ,Measurement of Volume Respiratory Gas Analyzers, Acid-base Balance, Blood pH Measurement, Blood pO2 Measurement.

(06 Hours)

Unit 5: Modern Imaging Systems

Basis of Diagnostic Radiology, Nature and Production of X-rays, Visualization of X-rays
Physical Parameters for X-ray Detectors, Ultrasonic Imaging Systems Medical Ultrasound, Basic Pulse-echo Apparatus, *A*-Scan, Echocardiograph (M-mode), *B*-Scanner, *Real*-time Ultrasonic Imaging Systems, MRI

(05 Hours)

Unit 6: Therapeutic Equipment

Cardiac Pacemakers: Need for Cardiac Pacemaker, External Pacemakers *Implantable* Pacemakers. Cardiac Defibrillators: Need for a Defibrillator, DC Defibrillator, and Implantable Defibrillators Ventilators: Its types and characteristics.

(06 Hours)

VII Semester
ET2432-PE V: Biomedical Instrumentation

Text books:				
1	Handbook of Biomedical Instrumentation	1st edition	R.S.Khandpur TMH	TMH
2	Introduction to Biomedical Instrumentation	-	By Mandeep Singh	PHI

Reference books:				
1	Biomedical Instrumentation & Measurement ,	2nd edition 1990	By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer PHI	PHI

VII Semester
ET 2433 – PE V: Fuzzy Logic & Neural Network

Prerequisites	**Basic set theory,** Basic probability and statistics**,** linear algebra and calculus
Course Objectives Students should be able to 1. Learn computing algorithms in Neural network and Fuzzy logic concepts 2. Understand operation of basic elements in fuzzy controller, fuzzy reasoning, relations. 3. Understand supervised and unsupervised algorithms in neural networks. 4. Learn deep learning fundamentals and develop algorithms to solve real life applications.	**Course Outcomes** Students will be able to 1. Examine fuzzy logic, neural network and deep learning models 2. Apply fuzzy logic for solving problems 3. Apply supervised/unsupervised algorithms for pattern recognition 4. Analyze the concepts of deep learning models for computer vision analysis

UNIT-1 Fuzzy Logic & Arithmetic Operations

Fuzzy Sets, Operations on Fuzzy Sets, Membership Functions, fuzzy compliments, t-norms and t-conorm**,** extension principle, Fuzzy arithmetic operation on intervals and on fuzzy sets, lattice of fuzzy numbers, fuzzy equations **(06 Hours)**

UNIT-2 Fuzzy Relations & Decision Making

Fuzzy relations, projections and cylindric extensions, binary fuzzy relations, fuzzy equivalence, Fuzzy Rules and Fuzzy Reasoning, Fuzzy implications, Fuzzy Inference Systems, Fuzzy Decision Making, Fuzzy controllers **(6 Hours)**

UNIT-3: Neural Network Concepts

Introduction to Biological neural network, and Artificial Neuron Models, Neural Network learning rules, NN architectures, Hebb Net, Learning in single discrete and continuous perceptron, Perceptron training algorithm**,** Feed forward vs feedback networks, ADALINE, MADALINE NN **(06 Hours)**

UNIT-4: Supervised Neural Networks

Supervised Learning Neural Networks, Backpropagation algorithm, factors affecting back propagation training, Radial Basis Function Networks, Recurrent Networks, Adaptive Multilayer NN **(06 Hours)**

UNIT 5: Unsupervised Neural Networks

Unsupervised Learning Neural Networks, Winner take networks, Adaptive Resonance architectures, Self-Organizing Map, Associate memory models **(06 Hours)**

Unit 6: Deep learning

Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Basic structure of Convolutional Network, Case studies: Alex net, VGGNet, GoogLeNet, Applications of CNN: Train deep neural networks for computer vision tasks, **New topic to be announced time to time (06 Hours)**

VII Semester

ET 2433 – PE V: Fuzzy Logic & Neural Network

Text books:				
1	Fuzzy Sets and Fuzzy Logic:Theory and Applications	1996	George J. Klir and Bo Yuan	Prentice Hall
2	Neural Networks, Fuzzy Systems and Evolutionary Algorithms: Synthesis and Applications	2017, 2nd edition	S. Rajasekaran and G. A. Vijayalakshmi Pai	Prentice Hall of India
3	Elements of Artificial Neural Network	2009	K. Mehrotra	Penram International Publishing Pvt Ltd; Second edition MIT, Cognet
4	Neural Networks and Deep learning	2018	Charu C. Aggarwal	Springer International Publishing

Reference books:				
1.	Fuzzy Logic with Engineering Applications	3rd Edition, 2011	Timothy J.Ross,	McGrawHill, New York
2.	Principles of Soft Computing	2011, 2nd edition	S. N. Sivanandam, S. N. Deepa	Wiley India Pvt Ltd
3.	"Neural Networks and Deep Learning", http://neuralnetworksanddeeplearning.com	2015	Michael Nielsen	Determination Press
4.	Deep learning .	2015	Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville.	An MIT Press book in preparation

VII Semester
ET 2434 -PE V: Wireless Sensor Networks

Course Objectives	**Course Outcomes**
Students should be able to: 1. Understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology 2. Understand the medium access control protocols and address physical layer issues 3. Learn key routing protocols, transport layer protocols for sensor networks, and design requirements 4. Understand the Sensor management, sensor network middleware, operating systems.	Students will be able to: 1. Elaborate common wireless sensor networks. 2. Elaborate network, physical and MAC layer for WSN. 3. Explain Localization and positioning system for WSN 4. Explain topology, and clustering methods for WSN 5. Explain different routing protocols for WSN

UNIT-1:
Characteristics Of WSN: Characteristic requirements for WSN - Challenges for WSNs, Applications Of WSN – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot. **(06 Hours)**

UNIT-2:
Network architecture-optimization goal and figure of merit-design principles for WSN, service interface of WSN, Gateway concept challenges of WSN, comparison with other network. Wireless channel and communication fundamental, physical layer and transceiver design consideration in WSN. **(06 Hours)**

UNIT-3
Medium Access Control Protocols: Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contention- based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA), IEEE 802.15.4 MAC protocol **(06 Hours)**

UNIT-4:
Naming and addressing, Time synchronization, Properties of Localization and positioning procedures, single hop localization, positioning in multihop environments, and impact of anchor placement **(06 Hours)**

UNIT-5
Topology control-controlling topology in a flat network, Hierarchical network by dominating set, Hierarchical network by clustering, combining Hierarchical topologies and power control. (**06 Hours)**
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UNIT-6:
Routing protocols, Gossiping and agent-based unicast forwarding, Energy-efficient unicast, Broadcast and multicast, Geographic routing, Mobile nodes, Data centric routing, Data aggregation, Data centric storage
(06 Hours)

VII Semester
ET 2434 -PE V: Wireless Sensor Networks

Text books:				
1	Wireless Sensor Networks Technology, Protocols, and Applications"	2010	Kazem Sohraby, Daniel Minoli and Taieb Znati,	John Wiley & Sons,
2	Protocols and architecture for Wireless sensor Networks Wiley	2011	Holger Karl, Andreas Willig,	Wiley Publications
3	Wireless Sensor Network Designs,	2003	Anna Hac	Wiley Publications

Reference books:				
1	Wireless Sensor Networks : A systems perspective	August 2005	NirupamaBulusu and Sanjay Jha,	Artech House Publications
2	Wireless Sensor Networks : Architecture and Protocols	2003.	Jr., Edgar H. Callaway,	Auerbach Publications
3	Wireless Sensor Networks	2005 C.S.	Raghavendra, Krishna M. Sivalingam and TaiebZnati	Springer Publications

VII Semester
ET2435 – PE V : RF Circuit Design

Course Objectives Students should be able to	Course Outcomes Students will be able to
1) Learn fundamentals of series and parallel RF circuits. 2) Understand the use of HF component in design the RF circuit and bandwidth estimation techniques. 3) Learn the design of high frequency amplifier an phase detectors 4) Understand the concept of CMOS technology in RF circuits.	1) Analyse the behaviour of series and parallel RLC circuit at High Frequency. 2) Elaborate the MOSFET based circuit design and different bandwidth estimation techniques. 3) Design high frequency amplifier for RF applications 4) Explain RF Power Amplifiers, Phase Detectors and biasing of RF Circuit

UNIT-1 Fundamentals of RF Circuits

Introduction, History of wireless Communication, Noncellular wireless Applications, Propagation, Parallel RLC Tank Circuit, Series RLC Circuit , RLC Network as Impedance Transformer, Skin Effect, Resistor, Capacitor, Inductor **(06 Hours)**

UNIT-2: MOSFET and Transmission Lines

MOSFET Physics, MOS Device Physics in Short Channel Regime , Other Effects, Link Between Lumped and Distributed Regime ,Driving Point impedance at iterated structures , Transmission line , Behavior of finite length Transmission line. **(06 Hours)**

UNIT-3: Bandwidth Estimation

Review of Smith Chart and S-Parameter, Application of smith chart, Rise time, Delay, Bandwidth Estimation Techniques - Open Circuit Time Constant, Short Circuit Time constant **(06 Hours)**

UNIT 4: HF RF Amplifier and Bandwidth Detection

Introduction to High Frequency Amplifier Design, Zeros as Bandwidth Enhancer , The shunt series Amplifier, Tuned Amplifiers, Neutralization and Unilateralization Cascaded Amplifiers **(06 Hours)**

Unit 5: Biasing of RF Circuit

Introduction to Voltage references and Biasing, Review of Diode Behavior, Diodes and Bipolar transistors in CMOS Technology Supply independent bias circuits, Band gap Voltage References, Amplifier linearity. **(06 Hours)**

Unit 6: RF Power Amplifier and Phase Detectors

Introductions to RF Power Amplifiers, Classification of Power Amplifiers, Modulation of Power Amplifiers, Introduction to Phase lock loops , Linear zed PLL Model, Phase Detector, Sequential Phase Detector, Loop Filters and Charge Pumps **(06 Hours)**

VII Semester
ET2435 – PE V : RF Circuit Design

Text books:				
3.	The Design of CMOS Radio Frequency Integrated Circuits	2nd Edition	Thomas H. Lee	Cambridge University Press
4.	RF Circuit Design Theory and Applications	2nd Edition	R. Ludwig & P. Bretchko	Pearson Publication

Reference books:				
5.	Analysis and Design of Analog Integrated Circuits	4th Edition	Paul R. Gray	Whiley India Publication

VII Semester
ET2441-PE VI : CMOS VLSI Design

Prerequisites	Logic Circuit Design, MOSFET Operation, Sequential Circuits
Course Objectives Students should be able to 1) Understand and study analysis of the MOS transistor with first order and second order effects. 2) Study the static and dynamic operating principles of inverter circuit. 3) Understand the different CMOS implementation process. 4) Learn switching characteristics and interconnection effects of MOS device, advanced techniques in CMOS logic.	**Course Outcomes** Students will be able to 1) Elaborate the characteristics of MOSFET, MOSFET based circuits and process of CMOS circuits fabrication 2) Design the MOSFET inverters, combinational and sequential circuits. 3) Design optimized CMOS circuits and layouts 4) Analyze switching characteristics and interconnection effects of MOS device, advance CMOS logic circuits.

UNIT –I: Basic MOS Device Physics
General Consideration: MOS as a switch, MOS Structure & Symbols, MOS I/V Characteristics, MOS Enhancement Transistor, Second order effect of MOS: Body Effect, Junction Effect, Gate Leakage Effect, Channel Length Effect, Tunneling Effect, Velocity Modulation, Mobility Variation **06 Hrs**.

UNIT-2: MOSFET Inverter Characteristics
Resistive Load Inverter, Inverter with n type MOSFET load, CMOS Inverter, Principle of operation & DC Characteristics, Tri-stated Inverter, Noise Margin Calculation. **07 Hrs**

UNIT-3: Fabrication & Layout of CMOS IC
CMOS Fabrication Technology: N-well, P-well, Twin Tub Process, Silicon on Insulator (SOI) Process, Physical Design of Logic Gates, Euler's Path, Stick Diagram, Layout, Latch-up Effect. **06 Hrs**

UNIT-4: Switching Characteristics & Interconnection Effect
MOS Device Capacitance Estimation, Switching Characteristics: Rise Time, Fall Time, Propagation Delay, Delay Estimation: Propagation Delay, Contamination Delay, Power Dissipation in CMOS: Static & Dynamic Power Calculation, Charge Sharing, Fan-in, Fan-out. **05 Hrs**

UNIT-5: Combinational Circuit Design
Circuit Families, Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass-Transistor Circuits, Circuit Pitfalls, More Circuit Families. **06 Hrs**

UNIT-6: Sequential Circuit Design
Introduction, Sequencing Static Circuits. Sequencing Methods , Max-Delay Constraints, Min-Delay Constraints, Time Borrowing, Clock Skew, Circuit Design of Latches and Flip-Flops, Conventional CMOS Latches, Conventional CMOS Flip-Flops, Design Using Various Logic Families such as Pseudo NMOS Logic, Dynamic CMOS Logic, CMOS Domino Logic, Zipper Logic, Clocked CMOS Logic, CVSL, Bi-CMOS Logic Family **06 Hrs**

VII Semester
ET2441-PE VI : CMOS VLSI Design

Text books:				
1	"Introduction to VLSI Circuits and Systems"	First Edition	John P. Uyemura	Wiley Publication.
2	"Principle of CMOS VLSI Design"	2nd Edition, 1994.	Neil H. E. Weste, K. Eshraghian	Addison Wesley VLSI Series.

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,	Tata Mc- Graw Hill,

VII Semester
ET2442– PE VI: Digital Image Analysis for Remote Sensing

Prerequisites	Principles of Image Analysis
Course Objectives 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 Outcomes** Students will be able to 1) Elaborate the basic and applied principles of remote sensing and RS image characteristics 2) 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

(06 Hours)

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

(06 Hours)

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 – wavelet transforms.

(06 Hours)

UNIT 4: Geometric Correction

Sensor geometry and empirical models for geometric corrections techniques.

(06 Hours)

Unit 5: RS Image Classification

Thematic Information Extraction: review of supervised and unsupervised Image classification – Maximum Likelihood and Bayesian classification, Non-parametric & parametric classification.

(06 Hours)

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, **New topic to be announced time to time** **(06 Hours)**

VII Semester
ET2442– PE VI: Digital Image Analysis for Remote Sensing

Text books:				
1	Remote Sensing: Models and Methods for Image Processing	Third Edition, 2007	Robert A. Schowengerdt	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 University Press

VII Semester
ET 2443- PE VI: Microwave Integrated circuits

Prerequisites	**RF & Microwave, UHF.**
Course Objectives Students should be able to 1) To understand the various microwave Integrated circuits components 2) Develop the hands-on Trainer Kits of MIC. 3) To analyze the various passive & active MIC components. 4) To get hands on spectrum analyzer. and analyze different microstrip component on it.	**Course Outcomes** Students will be able to 1) Explain the planar transmission lines. 2) Design active and passive components and planner antennas using microstrip lines. 3) Design active and passive circuits using microstrip lines. 4) Elaborate different active and passive components and Microstrip Patch antenna. 5) Elaborate the fabrication process of MIC Devices and Components.

UNIT-1: Introduction to planar Transmission Lines:
Microwave Communication System, Microwave Component System, Microstrip lines, Striplines Characteristic impedance, Guide wavelength and loss, Slot line – Wave-guide analysis, coupling coaxial and micro strip lines Coplanar line: Analysis using conformal transformation and Hybrid mode method . **06 Hrs**

UNIT-2: Micro strip line devices:
Micro strip coupler and branch-line couplers, even and odd mode analysis, coupling coefficient and bandwidth. Impedance transformers and filters, Lumped elements for MIC design and fabrication of inductors, resistors and capacitors, Non-reciprocal components, micro strip circulators, isolators, phase shifters **06 Hrs**

UNIT-3: Planar Antennas:
Types of Antennas, Radiation mechanism, radiation fields, patch antennas, traveling wave antennas, slot antennas, Excitation techniques, surface waves, Advantages and Disadvantages of Microstrip antennas , Methods of analysis **06 Hrs**

UNIT-4: Design of micro strip circuits:
High power circuits – Transistor Oscillator, step recovery diode frequency multiplier, avalanche diode oscillator, PIN diode switch, Low power circuits : Schottky diode, Balanced mixer, parametric amplifier, PIN diode limiter, Diode phase shifter . **06 Hrs**

UNIT-5: Hybrid MICs:
MIC substrate Materials, Dielectric Substrates properties, Fabrication Technology: Thick film technology, Thin film technology, Methods of testing, Encapsulation of devices, and mounting **05 Hrs**.

VII Semester
ET 2443- PE VI: Microwave Integrated circuits

UNIT-6: Monolithic MICs fabrication:
Introduction to MMICs , Fabrications, Technologies used in MMICs, Epitaxial growth, Diffusion, Ion implantation, Electron Beam technology for pattern delineation **06 Hrs**
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Text books:				
1	"Microwave Engineering"	3rd Edition	David Pozar	Wiley Ind. Publishers
2	"Microwave Devices and Circuits"	. 3rd Edition	Samuel Liao	Prentice-Hall of India Ltd
3	"Antennas and Radio Wave Propagation,"	3rd Edition	R.E.Collin	McGraw Hill Publishers 1985
Reference books:				
1	"Strip like Transmission Line for MIC"	--	Bharti Bhat and S. K. Koul	New Age International.
2	"Microwave Integrated Circuits"	--	K. C. Gupta and Amarjit Singh	Wiley East. Ltd, 1974
3	"Micro strip Antennas"	--	I.J. Bahl and P. Bhartia	Artech House1980.

VII Semester
ET2444 – PE VI: Communication Networks

Course Objectives Students should be able to	Course Outcomes Students will be able to
1) Understand Networks, Network topologies and service primitives. 2) Learn the structure and applications of Connecting devices. 3) Learn basics of LAN, MAN, WAN. 4) Understand Multimedia Networking. 5) Comprehend Network applications and Network Securities	1) Select the appropriate topologies and techniques for design of communication system 2) Elaborate the design techniques and protocols of computer networks. 3) Elaborate flow control and error control techniques in communication network 4) Solve problems based on evaluation of errors, class-full & classless addressing and data security in communication networks.

Unit-1 Computer Network and Internet **6 Hours**

Internet, the network edge, ISPs and Internet backbone, Protocol layers and their service models, History of Computer network and Internet

Unit-2 Application Layer **6 Hours**

Principles of Network Applications, the web and HTTP, FTP, Email, DNS,

Unit-3: Transport Layer **6 Hours**

Transport layer design issues, transport service primitives, internet transport protocol TCP/IP architecture TCP/IP protocol, TCP/IP utilities, wireless TCP, Congestion and Congestion Control Mechanism

Unit-4: Network layer **6 Hours**

Introduction, virtual circuit and datagram networks, internet protocol, routing algorithm, routing in the internet, broadcast and multicast routing

Unit-5: The link layer and Local area Network **6 Hours**

Services, error detection and correction techniques, multiple access protocols, and link layer addressing, Ethernet, Hubs and Switches, PPP

Unit-6: Security in Communication Networks **6 Hours**

Network Security, cryptography, authentication, Integrity, firewalls, attacks and countermeasures,

VII Semester
ET2444 – PE VI: Communication Networks

Text books:				
1	**Data Communication and Networking**	Behrouz Forouzan	**Fifth Edition**	McGraw Hill
2	**Computer Networking A top down Approach Featuring and Internet**	James F. Kurose	**Third Edition**	**Pearson**
Reference books:				
1	**Computer Networks**	Andrew Tanenbaum	**Fourth Edition**	Prentice Hall PTR

VII Semester
ET2445- PE VI: Computer Architecture and Organization

Course Objectives	Course Outcomes
Students should be able to 1) Study the fundamentals and advance concepts of computer architecture and different arithmetic operation including the algorithms & implementation for fixed-point and floating-point numbers. 2) Understand control unit operations and performances issues 3) Study and apply the Study the hierarchical memory system including cache memories and virtual memory.. 4) Study the concepts of pipelining and Parallel Processors.	Students will be able to 1) Elaborate the fundamentals and advanced concepts in computer organization 2) Explain Instruction set architecture of a CPU and 3) Elaborate the fundamentals of control unit design and memory hierarchy 4) Explain the concepts of parallel processing and peripheral interfacing

UNIT-1

Basic functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic - integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication - shift-and-add, Booth multiplier, carry save multiplier, etc. Division - restoring and non-restoring techniques, floating point arithmetic. **(6Hrs)**

UNIT-2:

Instruction set architecture of a CPU - registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. CISC, RISC architecture Case study - instruction sets of a generic CPU. **(6Hrs)**

UNIT-3:

Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit. Microprogrammed Control - Basic concepts, minimizing microinstruction size, multiplier control unit. Microprogrammed computers - CPU control unit **(6Hrs)**

UNIT-4:

Memory hierarchy – main memory – types and interfacing; Cache memory – its organizations and operations, levels of caches; Memory management module – paging and segmentation, virtual memory; Disk memory, RAIDs. Back-up memory **(6Hrs)**

UNIT-5:

Pipelining:Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency. **(6Hrs)**

VII Semester
ET2445- PE VI: Computer Architecture and Organization

UNIT -6

Peripheral devices and their characteristics: Input-output subsystems, I/O transfers - program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes - role of interrupts in process state transitions.

(6Hrs)

Text Books			
1	Computer Organization and Design: The Hardware/Software Interface	David A. Patterson and John L. Hennessy	5th Edition Elsevier
2	Computer Organization and Embedded Systems	Carl Hamacher	McGraw Hill Higher Education 6th Edition
3	Computer architecture and organization	Carl Hamacher	McGraw Hill Higher Education 4th Edition

Reference Books			
1	Computer Architecture and Organization	John P. Hayes	WCB/McGraw-Hill 3rd Edition
2	Computer Organization and Architecture: Designing for Performance	William Stallings	10th EditionPearson Education.
3	Computer System Design and Architecture	Vincent P. Heuring and Harry F. Jordan,	2nd Edition Pearson Education

VII Semester
ET2446 – PE VI: PLCs & SCADA

Course Objectives Students should be able to:	Course Outcomes Students will be able to:
1) Understand the fundamentals of Automation and their applications, systems used in industry such as PLC, Memory devices, Input /Output system and Relays. 2) Learn PLC and SCADA programs for industrial automation. 3) Understand the concepts of HMI & SCADA 4) Understand the concepts in distributed control systems	1) Explain the basic building blocks of Programmable logic controller 2) Develop PLC and SCADA programs for industrial automation. 3) Illustrate the concepts involved in HMI & SCADA 4) Elaborate the concepts in distributed control systems

UNIT-1 :-
Introduction to Programmable Controllers
Definition , A Historical Background , Principles of Operation , PLCs Versus Other Types of Controls , PLC Product Application Ranges, Advantages of PLCs, PLC Sizes and Scopes of Applications, **Overview of PLC System.** **(06Hours)**

UNIT-2:
Introduction to Programming Languages
Types of PLC Languages, Ladder Diagram Format , Ladder Relay Instructions , Ladder Relay Programming, IEC 1131-3 Programming Languages – FBD/ST/IL/SFC, **Programming Instructions**
NO-NC & coil based instructions(Relay based Instructions), Timers, Counters, Compare, Mathematics, Jump and Subroutines. **(06 Hours)**

UNIT-3:
Introduction to SCADA
Introduction and brief history of SCADA, Fundamental principles of modern SCADA systems, the components of a SCADA system, Types of SCADA,

SCADA Programming
Graphics Building & Simulation, Tag types & Management, Tools, Programming techniques, Alarms & Trends Configuration, Screen Navigation **(06 Hours)**

UNIT 4:
Introduction to HMI

FOUNDATIONS OF HMI: The Human: History of User Interface Designing, Types, Features, General architecture , Conventional & current HMI systems, Difference between HMI & SCADA, HMI Hardware interfaces, Practical uses in Industries. **(06 Hours)**

Nagar Yuwak Shikshan Sanstha's

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BE SoE and Syllabus 2018

ELECTRONICS & COMMUNICATION ENGINEERING

VIII Semester

ET2451 - Major Project

COURSE OBJECTIVES	COURSE OUTCOME
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. To analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	On successful completion of the course students will be able to: 1. Demonstrate a sound technical knowledge of their selected project topic. 2. Undertake problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Communicate effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1,2,3,4,5,6,7,8,9,10,11,12 **PSO** : i,ii,iii	

The group of students will continue to work for the project allotted previously and will submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

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ELECTRONICS & COMMUNICATION ENGINEERING

VIII Semester

ET2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
1. To expose to culture and tradition. 2. To provide opportunity for student to perform and present their hidden talent, still and art. 3. To nurture hobbies. 4. To organize co-curricular activities to make competitive spirit, cooperation, leadership, diligence, punctuality, team spirits. 5. To develop creative talent, self-confidence, sense of achievement. 6. To be able to design process on environmental, social, political, ethical, health and safety. 7. To develop broad education to understand the impact of engineering solution in a global economic, environmental, society.	1. An ability to work initially as well as part of team to achieve set goals. 2. An ability to work to serve society and for betterment of society. 3. An ability to communicate with people at large.
Mapped Program Outcomes : 5,6,7,9,10,11	

Due credits will be given to the students based on their performance and involvement in different extra and co-curricular activities conducted within the college or by other organizations/ institutions. Due credit will also be given to the student if they are successful in different competitive examinations conducted by different organizations. The guidelines as given in academic regulations will be followed for evaluation.