Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2015
'B' Grade (CGPA 2.62)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: ELECTRONICS & TELECOMMUNICATION ENGINEERING

Name of the Course: S.Y. B. Tech. (Sem- III & IV)

(Syllabus to be implemented from w.e.f. June 2019)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

FACULTY OF SCIENCE & TECHNOLOGY

ELECTRONICS & TELECOMMUNICATION ENGINEERING

Syllabus Structure for

S.Y. B.Tech. (Electronics & Telecommunication Engineering)

w.e.f. Academic Year 2019-20

T.Y. B.Tech. (Electronics & Telecommunication Engineering)

w.e.f. Academic Year 2020-21

Final Year B.Tech. (Electronics & Telecommunication Engineering)

w.e.f. Academic Year 2021-22

Choice Based Credit System

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

FACULTY OF SCIENCE & TECHNOLOGY

Electronics & Telecommunication Engineering

Programme Educational Objectives and Outcomes

A. Program Educational Objectives

1. To make students competent for professional career in Electronics, Telecommunication and allied fields.
2. To build strong fundamental knowledge amongst student to pursue higher education and continue professional development in Electronics, Telecommunication and allied fields.
3. To imbibe professional ethics, develop team spirit and effective communication skills to be successful leaders and managers with a holistic approach.
4. To nurture students to be sensitive for ethical, societal & environmental issues while conducting their professional work.

B. Program Outcomes

Engineering Graduate will be able to –

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of t h e engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

C. Program Specific Outcomes

1. Graduates will be able to attain a **solid foundation** in Electronics and Communication Engineering with an ability to function in multidisciplinary environment.
2. Graduates will be able to use **techniques and skills** to design, analyze, synthesize, and simulate Electronics and Communication Engineering components and systems.
3. Graduate will be capable of **developing programs** in Assembly, High level and HDL languages using contemporary tools for software development.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science & Technology

(Revised from 2018-19)

C.B.C.S. Structure of S.Y. B.Tech. Electronics & Telecommunication Engineering W.E.F. 2019-20

Semester I

Course Code	***Theory Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
ET211	Engineering Mathematics – III	3	1	--	4	30	70	25	125
ET212	Electronic Circuit Analysis and Design	4	--	--	4	30	70	25	125
ET213	Network Theory and Analysis	4	--	--	4	30	70	25	125
ET214	Digital Techniques	4	--	--	4	30	70	25	125
ET215	Analog Communication	3	--	--	3	30	70	25	125
Sub Total		18	1	--	19	150	350	125	625
ENV21	Environmental Science	1	--	--	--	--	--	--	--
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET212	Electronic Circuit Analysis and Design	--	--	2	1	--	50*	--	--	50
ET213	Network Theory and Analysis	--	--	2	1	--	--	--	--	--
ET214	Digital Techniques	--	--	2	1	--	50	--	--	50
ET215	Analog Communication	--	--	2	1	--	25	--	--	25
E216	Electronics Software Lab-I	--	1	2	2	--	--	--	50	50
Sub Total		--	1	10	6	--	125		50	175
Grand Total		**19**	**2**	**10**	**25**	**150**	**475**		**175**	**800**

Abbreviations: L- Lectures, P –Practical, T- Tutorial, ISE- In Semester Exam, ESE-End Semester Exam, OE-Oral Examination, POE- Practical Oral Examination, ICA- Internal Continuous Assessment

Note: *

- Practical and Oral Examination of Electronics Circuit Analysis and Design includes some of the practical from subject of Network Theory and Analysis

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science & Technology

(Revised from 2018-19)

C.B.C.S. Structure of S.Y. B. Tech. Electronics & Telecommunication Engineering W.E.F. 2019-20

Semester II

Course Code	***Theory Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
ET221	Control System	3	--	--	3	30	70	25	125
ET222	Analog Integrated Circuits	4	--	--	4	30	70	25	125
ET223	Principles of Digital Communication	4	--	--	4	30	70	25	125
ET224	Signals and Systems	3	1	--	4	30	70	25	125
ET225	Data Structures	4	--	--	4	30	70	25	125
Sub Total		18	1	--	19	150	350	125	625
ENV22	Environmental Science	1	--	--	--	--	--	--	--
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET221	Control System	--	--	2	1	--	--	--	--	--
ET222	Analog Integrated Circuits	--	--	2	1	--	50	--	--	50
ET223	Principles of Digital Communication	--	--	2	1	--	25	--	--	25
ET225	Data Structures	--	--	2	1	--	50	--	--	50
ET226	Electronic Software Lab-II	--	1	2	2	--	--	--	50	50
Sub Total		--	1	10	6	--	125		50	175
Grand Total		**19**	**2**	**10**	**25**	**150**	**475**		**175**	**800**

Abbreviations: L- Lectures, P –Practical, T- Tutorial, ISE- In Semester Exam, ESE - End Semester Exam, OE-Oral Examination, POE- Practical Oral Examination, ICA- Internal Continuous Assessment

 Note:

1. Student is required to study and pass Environmental Science subject in Second Year to become eligible for award of degree.

2. Batch size for the practical /tutorial shall be of 20 students. On forming the batches, if the strength of remaining students exceeds 9, then a new batch shall be formed.

3. Vocational Training (evaluated at Final Year Part-I) of minimum 15 days shall be completed in any vacation after S.Y. Part-II but before Final Year Part-I & the report shall be submitted and evaluated in Final Year Part-I

4. Student shall select one Self Learning Module at T.Y. Part I and T.Y. Part II each from Technical and Humanities and Social Sciences Group with at least one Self Learning Module from the Humanities and Social Sciences Group

5. Curriculum for Humanities and Social Sciences Self Learning Modules is common for all under graduate programmes of faculty of Engineering and Technology

6. ICA assessment shall be a continuous process based on student's performance in – class tests, assignments, homework, subject seminars, quizzes, laboratory books and their interaction and attendance for theory and lab sessions as applicable

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Science & Technology

(Revised from 2018-19)

C.B.C.S. Structure of T.Y. B.Tech. Electronics & Telecommunication Engineering W.E.F. 2020-21

Semester I

Course Code	***Theory Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
ET311	Electromagnetic Field Theory	3	1	--	4	30	70	25	125
ET312	Digital Design & HDL	4	--	--	4	30	70	25	125
ET313	Digital Signal Processing	4	--	--	4	30	70	25	125
ET314	Microcontrollers and Applications	4	--	--	4	30	70	25	125
ET315A & ET315B	Open Elective *SEPMS *Industrial Management	4	1	--	4	30	70	25	125
SLH31	Self Learning Module-I	--	--	--	2	--	50	--	50
Sub Total		19	2	--	22	150	400	125	675
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET312	Digital Design & HDL	--	--	2	1	--	50	--	--	50
ET313	Digital Signal Processing	--	--	2	1	--	50	--	--	50
ET314	Microcontrollers and Applications	--	--	2	1	--	50	--	--	50
ET316	Electronic Software Lab-III	--	1	2	2	--	--	--	25	25
Sub Total		--	1	8	5	--	150		25	175
Grand Total		**19**	**3**	**8**	**27**	**150**	**550**		**150**	**850**

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science & Technology

(Revised from 2018-19)

C.B.C.S. Structure of T.Y. B.Tech. Electronics& Telecommunication Engineering W.E.F. 2020-21

Semester II

Course Code	***Theory Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
ET321	Antenna & Wave Propagation	4	--	--	4	30	70	25	125
ET322	Embedded System	4	--	--	4	30	70	25	125
ET323	Electronic System Design	4	--	--	4	30	70	25	125
ET324	Advanced Mobile Communication	3	1	--	4	30	70	25	125
ET325A & ET325B	Elective-I *Optical Communication *Sensors & Applications	4	--	--	4	30	70	25	125
SLH32	Self Learning Module II	--	--	--	2	--	50	--	50
Sub Total		19	1	--	22	150	400	125	675
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET321	Antenna & Wave Propagation	--	--	2	1	--	--	--	--	--
ET322	Embedded System	--	--	2	1	--	50	--	--	50
ET323	Electronic System Design	--	--	2	1	--	--	#50	--	50
ET325A & ET325B	Elective-I *Optical Communication *Sensors & Applications	--	--	2	1	--	--	25	--	25
ET326	Mini Hardware Project	--	--	2	1	--	--	--	50	50
Sub Total		--	--	10	5	--	125		50	225
Grand Total		**19**	**1**	**10**	**27**	**150**	**525**		**175**	**850**

 Note –

1. # Practical and Oral Examination of Electronics System Design is combined with Mini-Hardware Project

2. Batch size for the practical /tutorial shall be of 15 students. On forming the batches, if the strength of remaining student exceeds 7, then a new batch shall be formed.

3. Vocational Training (evaluated at Final Year Part-I) of minimum 15 days shall be completed in any vacation after S.Y. Part-II but before Final Year Part-I & the report shall be submitted and evaluated in Final Year Part-I

4. Student shall select one Self Learning Module at T.Y. Part I and T.Y. Part II each from Technical and Humanities and Social Sciences Group with at least one Self Learning Module from the Humanities and Social Sciences Group

5. Curriculum for Humanities and Social Sciences Self Learning Modules is common for all under graduate programmes of faculty of Engineering and Technology

6. Minimum four assignments for Self Learning Modules at T.Y. Part I and T.Y. Part II shall be submitted by the students which shall be evaluated by a Module Coordinator assigned by institute / department

7. Project group for T.Y.(Electronics & Telecommunication) Part II Mini Project shall not be of more than **three** student

8. Project group for Final Year (Electronics & Telecommunication) Part I and Part II shall not be of more than **three** student.

9. ICA assessment shall be a continuous process based on student's performance in – class tests, assignments, homework, subject seminars, quizzes, laboratory books and their interaction and attendance for theory and lab sessions as applicable

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Science & Technology
(Revised from 2018-19)

C.B.C.S. structure of Final Year B.Tech. Electronics & Telecommunication Engineering W.E.F. 2021-22

Semester I

Course Code	***Theory Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
ET411	Microwave Engineering	4	--	--	4	30	70	25	125
ET412	Data Communication	4	--	--	4	30	70	25	125
ET413	Internet of Things	3	1	--	4	30	70	25	125
ET414	Database Management System	3	1	--	4	30	70	25	125
ET415A & ET415B	Elective-II * Image & Video Processing *Wireless Sensor Network	4	--	--	4	30	70	25	125
Sub Total		18	2	--	20	150	350	125	625
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET411	Microwave Engineering	--	--	2	1	--	--	--	--	--
ET412	Data Communication	-	--	2	1	--	50	--	--	50
ET413	Internet of Things	--	--	--	1	--	--	25	--	25
ET416	Project & Seminar	--	--	4	2	--	--	50	25	75
ET417	Vocational Training	--	--	--	1	--	--	--	25	25
Sub Total		--	-	8	6	--	125		50	175
Grand Total		**18**	**2**	**8**	**26**	**150**	**475**		**175**	**800**

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Engineering & Technology

(Revised from 2018-19)

C.B.C.S. Structure of Final Year B.Tech. Electronics & Telecommunication Engineering W.E.F. 2021-22

Semester II

Course Code	***Theory Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
ET421	Machine Learning	4	--	--	4	30	70	25	125
ET422	CMOS VLSI Design	4	--	--	4	30	70	25	125
ET423A & ET423B	Elective- III *Industrial IOT *Artificial Intelligence & Robotics	4	--	--	4	30	70	25	125
ET424A & ET424B	Elective-IV *Network Security * Data Analytics	4	--	--	4	30	70	25	125
Sub Total		16	--	--	16	120	280	100	500
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET421	Machine Learning	--	--	2	1	--	--	50	--	50
ET422	CMOS VLSI Design	--	--	2	1	--	50	--	--	50
ET425	Project	--	--	8	4	--	100	--	100	200
Sub Total		--	--	12	6	--	200		100	300
Grand Total		**16**	**--**	**12**	**22**	**120**	**480**		**200**	**800**

Note –

1. Batch size for the practical /tutorial shall be of 15 students. On forming the batches, if the strength of remaining students exceeds 7, then a new batch shall be formed.
2. Vocational Training (evaluated at Final Year Part-I) of minimum 15 days shall be completed in any vacation after S.Y. Part-II but before Final Year Part-I & the report shall be submitted and evaluated in Final Year Part-I
3. Appropriate Elective III toV Subjects may be added when required.

4. Project group for Final Year (Electronics & Telecommunication Engg) Part I and Part II shall not be of more than **Four** students.
5. ICA assessment shall be a continuous process based on student's performance in – class tests, assignments, homework, subject seminars, quizzes, laboratory books and their interaction and attendance for theory and lab sessions as applicable

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

S.Y. B.Tech (Electronics and Telecommunication Engineering) Part-I

ET211-Engineering Mathematics-III

Teaching Scheme:	**Examination Scheme:**
Lecture- 3 Hours / week, 3 Credits	ESE- 70 Marks
Tutorial - 1 Hours / week, 1 Credit	ISE - 30 Marks
	ICA- 25 Marks

Course Objectives:

1. To introduce to student method of solving higher order linear differential equations
2. To introduce to student Fourier series.
3. To introduce to student various probability distributions
4. To introduce to student Laplace and inverse Laplace transforms and their properties.
5. To make student understand Z transform and its properties
6. To introduce to student Fourier Transform.

Course Outcomes:

1. Student can solve higher order linear differential equation related to electrical circuit theory
2. Student can express a function in terms of sine's and cosines components so as to model simple periodic functions
3. Student can find the relation between two variables for the given data using regression and can explain various probability distribution functions.
4. Student can apply Laplace and inverse Laplace transforms for analysis of simple electrical circuits.
5. Student can solve problems on Z transform and explain its properties
6. Student can solve the problems of Fourier integral and Fourier transform

Course Prerequisite:

Fundamentals of trigonometry, method of finding roots of algebraic equations, differentiation, integration, partial fraction, sum of sequence and methods of solving definite integrations, basics of statistics and probability theory

SECTION – I

Unit 1: Higher order linear differential equations and applications [07 Hrs]

Basic definition, differential operator, complimentary functions, particular integral, Shortcu methods for standard functions like e^{ax} ,sin(ax+ b), cos(ax+b), xm , e^{ax}V and xV , particular integral by general method (without method of variation of parameters) for other functions. Electrical Engineering Applications

Unit 2 : Fourier series [06 Hrs]

Introduction, Definition, Euler's formula, Fourier series of periodic functions with period 2 and 2L, Dirichlet's theorem (only statement), even and odd functions, half range sine and cosine series.

Unit 3: Statistics and Probability: **[08 Hrs]**

Coefficient of correlation by Karl Pearson's method and lines of regression of bivariate data. Random variable, discrete and continuous random variable, Probability density function , Binomial, Poisson and Normal distributions.

SECTION II

Unit 4:Laplace transform: **[09Hr]**

Definition, Laplace transform of standard functions, properties- first shifting, change of scale, multiplication of power t and division by t, Laplace transform of derivative and integral, Laplace transform of periodic functions, unit step functions and unit impulse functions.

Definition, Inverse Laplace transform of standard functions, Properties of inverse Laplace transforms- linear property, first shifting theorem, partial fraction, inverse transform of logarithmic & inverse trigonometric functions and convolution theorem, solution of differential equations by Laplace transform.

Unit 5 Z-Transform: **[06Hr]**

Introduction, Z-Transform of standard sequence, properties of Z-transform – linearity, change of scale, shifting property, multiplication by k, division by k, inverse Z-transform –power series method, partial fraction method.

Unit 6: Fourier Transform: **[06Hr]**

Fourier integral, Fourier sine and cosine integral, Complex form of Fourier integral. Fourier Transform, Fourier sine and cosine transform and Inverse transform.

- Internal Continuous Assessment (ICA):
  ICA shall consist of minimum six to eight assignments based on entire curriculum
- Text books:
  1. A textbook of Applied Mathematics Vol. II and Vol. III, J.N. and P.N. Wartikar, Vidyarthi Grah Prakashan, Pune.
  2. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publications, Delhi.
  3. Numerical Methods, Dr.B.S.Grewal, Khanna Publications, Delhi
  4. A Textbook of Applied Mathematics, N.P. Bali, Ashok Saxena and N.Ch. S.N. Iyengar, Laxmi Publications, Delhi.
  5. Advanced Engineering Mathematics, Kreyzig-John Wiley & SMS, New York.

- Reference Books:
  1. Advanced Engineering Mathematics, Peter O'Neil , Cengage Learning.
  2. Engineering Mathematics, Srimanta Pal, Subodh Chandra Bhunia, Oxford University Press

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

S.Y. B.Tech (Electronics and Telecommunication Engineering) Part-I

ET212: Electronic Circuit Analysis And Design

Teaching Scheme:	**Examination Scheme:**
Lecture : 4 Hrs/Week	ISE:30 Marks
Practical :2Hrs/Week	ESE:70 Marks
	ICA:25 Marks
	POE: 50Marks

- **Course Objectives:**

1. To introduce to student working of FET and MOSFET and its applications.
2. To make student analyze transistorized multistage amplifier.
3. To make student design and analyze feedback amplifiers.
4. To make student analyze power amplifiers.
5. To make student design and analyze oscillators.

- **Course Outcomes: At the end of the course;**

1. Students will be able to analyze the working of JFET, MOSFET and applications of these devices.
2. Student can analyze multistage amplifier.
3. Student can analyze and design feedback amplifier.
4. Student can analyze power amplifiers.
5. Student can analyze and design oscillators.

SECTION– I

Unit 1: JFET: **[09Hrs]**

Introduction, Construction and working, JFET characteristics (Transfer and Drain), Schockley'sequation, JFET biasing and DC analysis, JFET as amplifier and its configurations (CS/CD/CG) and comparison, CS amplifier analysis. Designing of JFET CS Amplifier.

Unit 2: MOSFET: **[10Hrs]**

Two terminal MOS structure, EMOSFET-construction, symbols, EMOSFET V-I characteristics, additional MOSFET structures (DMOSFET and CMOS), V-I characteristics of EMOSFET (finite output resistance, body effect, break down effect, temperature effect, short channel effects), MOSFET biasing and DC circuit analysis, MOSFET small signal amplifier (CS configuration).

Unit 3: Multistage Transistor Amplifiers: **[05Hrs]**

Need of cascading, different coupling schemes with frequency response, h-model of BJT, Analysis of two stage RC coupled Amplifier, square wave testing for RC coupled amplifiers. Designing of two stage RC coupled Amplifier

SECTION-II

Unit 4: Feedback Amplifiers: [08Hrs]

Classification of amplifiers, feedback concept, General characteristics of negative feedback amplifiers, Feedback Topologies and analysis (with numerical examples), Effect of negative feedback on stability, Band width, noise, distortion, i/p resistance and o/p resistance. Darlington pair amplifier and its analysis.

Unit 5: Oscillators: [08Hrs]

Oscillator startup mechanism, Barkhausen's criteria , sinusoidal oscillators- RC phase shift Oscillator, Wein bridge oscillator, Colppits oscillator, Hartley oscillator Derivations for frequency of oscillations of above oscillators. Crystal oscillator- Piezo electric effect, electrical equivalent circuit of a crystal, UJT Relaxation oscillator. Designing of RC phase shift oscillator.

Unit 6: Power Amplifiers: [08Hrs]

Types (Class A, B, AB and C) and their comparison, crossover distortion, Second Harmonic distortion, Analysis of Class A, Class B and Class AB amplifiers, complementary symmetry push pull amplifier, Introduction to Class C amplifiers. Design of Class A& Class-B amplifier.

Note: For selection of components in design **Data Sheet** should be referred.

Internal Continuous Assessment (ICA):

Experiments: -

Minimum eight experiments from the following.

1. Frequency response of two stage RC coupled CE amplifier.
2. Effect of negative feedback on amplifiers.
3. V-I Characteristics of MOSFET
4. RC Phase shift oscillator.
5. Application of MOSFET as a switch.
6. V-I characteristics of JFET.
7. Implement JFET CS Amplifier and calculate Av, Ri and Ro.
8. Analysis of Class A power amplifier
9. Analysis Class B push pull Amplifier
10. Simulate two stage RC coupled CE amplifier with feedback
11. Simulate LC oscillator
12. Simulate MOSFET amplifier

- **Text books:**

1. Electronic Devices and Circuits Allen Mottershed PHI Publication.
2. Electronic Devices and Circuits- J.B.Gupta 3rd Edition KATSON Books.
3. A Practical approach to Electronic Circuit Design -D S Mantri& G P Jain,Nikita Publication
4. Electronics Devices and Circuits-S. Shalivahanan,N. SureshKumar, TMH Publication.

- **Reference Books:**

1. Electronic Devices Floyd Pearson Education
2. Microelectronics : Digital and Analog Circuits and Systems- Jacob Millman
3. Electronic Devices and Circuit Theory Boylestad Pearson Education
4. "Microelectronics Circuit" by Sedra Smith, Oxford University Press, 4thEdition.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

S.Y. B.Tech (Electronics and Telecommunication Engineering) Part-I

ET213: Network Theory And Analysis

Teaching Scheme:	**Examination Scheme:**
Lecture : 4 Hrs/Week	ISE:30 Marks
Practical : 2 Hrs/Week	ESE:70 Marks
	ICA:25 Marks

- **Course Objectives:**

1. To develop skills for analysis of linear circuits with dependent and independent AC/DC excitations.
2. To understand concept of resonance in electric circuits and its applications.
3. To analyze transient and steady state response for linear circuits.
4. To know fundamentals of two port network, passive filters, Attenuators.

- **Course Outcomes:**

1. Analyze linear circuit with use of different network theorems and analysis methods.
2. Compute two port network parameters and draw equivalent network.
3. Determine transient and steady state response of linear circuits.
4. Design passive filter and attenuator circuits.

- **Course Prerequisite:**

1. KVL, KCL, star-delta transformation, source transformation
2. Rectangular to polar conversion and vice versa.

SECTION– I

Unit 1: Circuit Analysis and Network Theorems: [10Hrs]

Types of Network Elements, Types of Sources and Source transformation, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems. Numerical problems based on AC and DC analysis.

Unit 2: Resonance: [06Hrs]

Series resonance: Series resonance, impedance and phase angle of series resonant circuit, voltage and current in series resonant circuit. Effect of resistance on frequency response curve, bandwidth, selectivity and quality factor. Significance of Quality factor.

Parallel resonant: Parallel resonant circuit (Tank circuit), resonant frequency, and variation ofImpedance with frequency, reactance curves. Numerical problems based on above.

Unit 3: Two Port Networks: [08Hrs]

Two port Network: Open circuit impedance parameters (Z), Short circuit admittance parameters (Y), Transmission parameters (ABCD), Hybrid parameters (H), and reciprocity and symmetry conditions. **Interconnection of two port networks:** Parallel, Series and Cascade connection of two portnetworks,Tand π representation, Terminated 2 port networks.

SECTION-II

Unit 4: Transient Response: **[09Hrs]**

Review of Laplace Transform Basics: Initial conditions, evaluation and analysis of transient and steady state response of following:

RL circuit: RL circuit step voltage response and step current response.

RC circuit: RC circuit step current response and step voltage response.

RLC circuit:RLC circuit step voltage response and step current response.

Unit 5: Network Function: **[06Hrs]**

Complex frequency: Concept of complex frequency.

Network function: network function for one port and two port network. Poles and Zeros of network function. Time domain behavior from poles and zero plot.

Unit 6: Filters and attenuators: **[09Hrs]**

Filters: Characteristic of high pass, low pass and band pass and band stop filter. Constant K type Filters, m-derived filter, section m derived LPF,HPF, BPF and BSF.

Attenuators: Relationship between Neperand Decibels, Design of T,π and Lattice attenuators.

Internal Continuous Assessment (ICA):

Notes: 1.Network Function unit should not include Stability concept, Routh Array as it is part of control system syllabus

2.Practical's and Oral Examination of Electronic Circuit Analysis and Design – I is combined With Network Theory and Analysis

Experiments: -

Minimum eight experiments from the following.

1. Verification of superposition theorem.
2. Verification of Maximum Power Transfer Theorems.
3. Frequency response of series resonance circuit.
4. Step response of RC circuit (Transient and steady state).
5. Verification of Z and Y parameters.
6. Verification of H parameters.
7. Design LPF, plot frequency response and find cut off frequency.
8. Design HPF, plot frequency response and find cut off frequency.
9. Design and verification of T-type attenuators.
10. Design and verification of π-type attenuator.
11. Network Graphs: Fundamental definitions, Incidence matrix, Fundamental cut set and Tie-set Matrix and simple circuit analysis using network graph

- **Text books:**

1. Circuit and network analysis and synthesis by A Sudhakar and Sham Mohan S Palli. TMH publication. 3rdEdition
2. Electric circuit analysis by Ramesh Babu, Scientech Publication
3. Circuit Theory (Analysis and Synthesis) A. ChakrabartiDhanpat Rai and Co. 6th Edition.
4. Network Analysis & Synthesis- Franklin Kuo, Wiley Publication.
5. Network Fundamentals & Analysis- Kaduskar, Wiley Publication.

- **Reference Books:**

1. Network Analysis M.E. Van Valkenburg, PHI publication. 3rd Edition
2. Network and System - D. Roy Choudhary, Wiley Eastern (2nd Edition).
3. Theory and problems of Electric Circuits Joseph Aedminster, Shaum Series
4. Network Analysis F.F.Kuo - John Wiley and Sons (2nd Edition).

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S.Y. B.Tech (Electronics and Telecommunication Engineering) Part-I

ET214: Digital Techniques

Teaching Scheme:	**Examination Scheme:**
Lecture : 4 Hrs/Week	ISE:30 Marks
Practical : 2 Hrs/Week	ESE:70 Marks
	ICA:25 Marks
	POE: 50Marks

- **Course Objectives:**

1. To understand principles, characteristics and operations of combinational and sequentialLogic circuits.
2. To develop design and implementation skills of combinational logic circuits.
3. To design, implement and analyze, asynchronous and synchronous sequential circuitsusing flip flops.
4. To design and verify VHDL modules for combinational logic circuits.

- **Course Outcomes: At the end of the course;**

1. Students will be able to design and realize combinational logic circuits using logic gates,MSI circuits and PLDs.
2. Students will be able to design, implement and analyze asynchronous andsynchronous Sequential circuits using flip flops.
3. Students will be able to apply digital concepts in industrial applications.

SECTION– I

Unit 1: Codes and Simplification technique: [05Hrs]

Codes- BCD and Gray codes, Seven segment, Principles of combinational logic: Standard representation for Logical Function, canonical forms, don't care conditions, minimization techniques (using K-map up to 4 variables only), static and dynamic Hazards.

Unit 2: Combinational Circuit Design: [09Hrs]

Adder, Subtractor, Code converters (binary to gray and gray to binary, BCD to 7 segment), IC 7447,MUX, DEMUX, encoder, priority encoder, decoder, Multiplexer (Tree) and Demultiplexer(Tree), magnitude comparator, adder with look ahead carry generator, Parallel adder(IC 7483), parity generator and checker.

Unit 3: Logic Families and flip flop: [10Hrs]

Logic Family-Introduction to logic families, Characteristics/Parameters of Digital ICs. Flip flop NAND Latch, Flip-Flop: D, SR, JK and T (Characteristic table, excitation table and characteristic equation), Race around condition, Master Slave J-K flip-flop, flip-flop conversion.

SECTION-II

Unit 4: Registers: [07Hrs]

Asynchronous and synchronous sequential circuits, Shift register (modes of operation), 4-bit bidirectional shift register, universal shift registers, Ring counter, Johnson counter, IC7495.

Unit 5: Counters and State machines: **[10Hrs]**

Design of ripple counter using flip-flop, 4 bit up/down counter, mod –N counter, Design of Synchronous counter using Flip-Flop, 4 bit up/down counter, mod –N counter, IC 7490, Moore and Mealy machines, representation techniques, state diagram, state assignment, state reduction, implementation using flip flops.

Unit 6: PLDs and VHDL: **[07Hrs]**

PLDs- PROM, PAL and PLA Architecture, CPLD, Implementing combinational circuits using PLDs.VHDL -Library, Entity, Architecture, VHDL code for adder, Subtractor and comparator.

Internal Continuous Assessment (ICA):

Experiments: -

Minimum Ten experiments from the following.

1. Implementation of SOP and POS logical functions using universal gates.
2. Implementation of full adder, and full subtractor using logic gates.
3. Code conversion using logic gates or logic ICs: BCD to Binary, Binary to Gray, Gray to Binary.
4. Design and implementation of 2 bit digital comparator using logic gates and functional Verification of 4 bit digital comparator using IC 7485.
5. Design and implementation of 1 decimal digit BCD adder using IC 7483.
6. (i) Verification of functionality of multiplexer.
(ii) Design and implement combinational logic function using multiplexer ICs.
7. (i) Verification of functionality of decoder.
(ii) Design and implement combinational logic function using decoder IC.
8. Verification of the functionality of BCD to Seven segment decoder/driver.
9. Implement S-R, D, J-K, T flip flops using logic gates.
10. Functional verification of universal shift registers using IC 7495.
11. Design and implementation of Ring counter using shift register.
12. Design and implementation of Johnson counter using shift register.
13. Design and implementation of Pulse train generator using IC 7495.
14. Functional verification of ripple counter using IC 7490
15. Design of half adder and half Subtractor using VHDL

- **Text books:**

1. Digital Design - M. Morris Mano - Pearson Education (3rd Edition)
2. Digital Principles – Leach, Malvino, TMH (6th Edition).
3. Fundamental of Digital Circuits- Anand Kumar- Prentice Hall of India Pvt. Ltd.
4. Digital Electronics – Dr. R. S. Sedha – S. Chand Publications (3rd Revised Edition).
5. Digital System, Principles and Applications, Ronald J. Tocci, PHI
6. Circuit Design using VHDL –VolneiPedroni, PHI Publications.
7. Digital Electronics- Anil K Maini, Wiley Publication.

- **Reference Books:**

1. Digital Design Principles and Application - Wakerly – Pearson Education
2. Digital Electronics - Gothman - (PHI)
3. Digital Logic and Computer Design - Morris Mano - Pearson Education
4. The Principles of Computer hardware- Alan Clements (Low Price 2000) (Third Edition),OxfordPress.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

S.Y. B.Tech (Electronics and Telecommunication Engineering) Part-I

ET215: Analog Communication

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week	ISE:30 Marks
Practical : 2 Hrs/Week	ESE:70 Marks
	ICA:25 Marks
	POE: 25 Marks

- **Course Objectives:**

The students are expected to demonstrate the ability to:

1. Describe and analyze the mathematical techniques of generation, transmission and reception of amplitude modulation (AM), frequency modulation (FM) and phase modulation (PM) signals.
2. Evaluate the performance levels (Signal-to-Noise Ratio) of AM, FM and PM systems in the presence of additive white noise.
3. Convert analog signals to digital format and describe Pulse and digital Modulation techniques.

- **Course Outcomes:**

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

1. Understand and identify the fundamental concepts and various components of analog communication systems.
2. Explain signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system.
3. Describe analog pulse modulation techniques and digital modulation technique.
4. Develop the ability to compare and contrast the strengths and weaknesses of various communication systems.

SECTION– I

Unit 1: Introduction: **[05Hrs]**

Introduction of Communication, Element of a communication systems, Base band & Carrier communication Modulation and Demodulation, Need of Modulation, Type of modulation, Type of communication Channels (Transmission line, Parallel wires, Coaxial cables, waveguides and optical fibers), Electromagnetic spectrum, Bandwidth, Concept of multiplexing (TDM and FDM), Application of communication.

Unit 2: Noise: **[06Hrs]**

Sources of Noise, Types of Noise, White Noise, Thermal noise, shot noise, partition noise, Low frequency or flicker noise, burst noise, avalanche noise, Signal to Noise Ratio, SNR of tandem connection, Noise Figure, Noise Temperature, Friss formula for Noise Figure, Noise Bandwidth, Behavior of Baseband systems and Amplitude modulated systems i.e.DSBSC and SSBSC in presence of noise.

Unit 3: AM Transmission: **[06Hrs]**

Base band & Carrier communication, Generation of AM (DSBFC) and its spectrum, Power relations applied to sinusoidal signals, DSBSC – multiplier modulator, Nonlinear generation, switching modulator, Ring modulator & its spectrum, Modulation Index. SSBSC, ISB & VSB, their generation methods & Comparison, Block Diagram of AM Transmitter and Broadcast technical standards.

SECTION-II

Unit 4: AM Reception: **[06Hrs]**

Block diagram of TRF AM Receivers, Super Heterodyne Receiver, Dual Conversion Super heterodyne Receiver, Concept of Series & Parallel resonant circuits for Bandwidth & Selectivity. Performance Characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection and IFRR. Tracking, Mixers. AM Detection: Rectifier detection, Envelope detection; Demodulation of DSBSC: Synchronous detection; Demodulation of SSBSC: Envelope detection

Unit 5: FM Transmission and Reception: **[07Hrs]**

Mathematical analysis of FM and PM, Frequency spectrum analysis of FM, Modulation Index Bandwidth requirements, Narrow Band and wide band FM, Comparison of AM,FM and PM, Direct and indirect methods of FM generation, Need for Pre-emphasis, De-emphasis. FM detection Techniques - Slope Detector, Dual Slope Detector, Foster Seeley Discriminator, RatioDetector.

Unit 6: Pulse Analog Modulation: **[06Hrs]**

Sampling Theorem, Proof of Sampling Theorem, Nyquist Rate and Nyquist Interval, Sampling Techniques - Natural sampling, Flat Top Sampling, Comparison of Various Sampling Techniques, Analog Pulse Modulation/Demodulation Methods- Pulse Amplitude Modulation, Pulse Time Modulation. Introduction to Pulse Code Modulation.

ICA : List of Experiments for Analog Communication

Perform any eight experiments from following.

List of Practical

1. AM Generation (DSB-FC): Calculation of modulation index by graphical method, Power of AM Wave for different modulating signal.
2. Envelope Detector - Practical diode detector, Observe effect of change in RC time constant which leads to diagonal and negative clipping
3. Generation of DSB-SC & its detection
4. SSB modulator & its detection
5. Frequency modulator & demodulator, calculation of modulation index & BW of FM.
6. Study of AM & FM Spectrum: Observe Spectrum of AM & FM, Compare & comment on AM & FM spectrum.
7. Verification of Sampling Theorem, PAM Techniques, (Flat top & Natural sampling), reconstruction of original signal, Observe Aliasing Effect in frequency domain.

Following can be performed using suitable software (Any One)

8. Generate AM and FM waveform for given modulation index, signal frequency and carrier Frequency using suitable software.
9. Prove sampling Theorem. Reconstruct the analog signal from its samples. Observe aliasing effect by varying sampling frequency.

Note: Visit to Broadcasting Station is desirable.

- **Text books:**

1. George Kennedy, “Electronic Communication Systems” 5th Edition, McGraw-Hill.
2. Dennis Roddy &Coolen, “Electronic Communication”,4th Edition, Prentice Hall.

- **Reference Books:**

1. B. P. Lathi, “Modern Digital and Analog. Communication Systems”, 3rd Edition, Oxford University Press.
2. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley & Sons.
3. Taub& Schilling, “Principles of Communication Systems”, Tata McGraw-Hill.
4. Frenzel, “Principles of Electronic Communication Systems”3rd Edition, Tata McGraw-Hill.

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S.Y. B.Tech (Electronics and Telecommunication Engineering) Part-I

ET216: Electronic Software Lab-I

Teaching Scheme:
Tutorial :1Hrs/Week
Practical :2Hr/Week

Examination Scheme:
ICA:50 Marks

Course Objectives

1. To study and implement advanced features of C programming language.
2. To develop the ability of building logic and analyze time and space complexity of the program.

Course Outcome

1. Students will be able to implement arrays and structures.
2. Students will be able to use string library functions and array of string.
3. Students will be able to implement dynamic memory allocation.

Course Prerequisite: Basic data structure types and elements, logical computation.

SECTION-I

Unit 1: Storage Classes and standard library functions [2 Hrs]

Automatic, Register, Static, External storage classes and standard library functions such as arithmetic functions, data conversion functions, character classification functions and time related functions.

Unit 2: Introduction to Arrays, Structures, & Functions in 'C': [2 Hrs]

1-D array, 2-D array, structure, Functions: Call by Value and Call by Reference, variable scope, creating records using array and structure.

Unit 3: String Processing [2 Hrs]

Declaration and initialization of strings, Display strings with different formats, string library functions, Array of strings.

SECTION II

Unit 4: Pointers [3 Hrs]

Introduction, Pointer to Pointer, Pointers to an Array, Array of Pointers, Pointer and Strings, Pointer and Structures, Dynamic memory allocation using malloc function.

Unit 5: Files [3 Hrs]

Introduction, Streams and file types, File operations, Different File I/O Functions, other file functions, command line arguments.

Unit 6: Algorithm Analysis [2 Hrs]

Introduction to Asymptotic Big–O notation, Omega Notation, Time complexity and space complexity.

Internal Continuous Assessment (ICA):

Students should perform minimum 10 experiments based on the following preferably conducted on Unix / Linux platform

1. Programs to demonstrate storage classes and functions like atoi(), itoa(), clock() etc.
2. Represent Sparse Matrix using arrays and perform Matrix Operations such as Addition and Multiplication.
3. Program to implement Magic Square by taking the size from user.
4. Program to implement concepts of functions such as call by value and call by reference.
5. Program to create a student table of size 10 using structure to perform insert and display operations.
6. Program to perform different string operations using string library functions.
7. Program to sort the strings alphabetically.
8. Programs to demonstrate: Array of Pointers, Pointer and Structures
9. Program to create a student database at run time using structure and pointer to perform different operations.
10. Program to simulate string library functions using pointers.
11. Menu driven program for performing the following operations on Files: Insert, Delete, Modify and Display records.
12. Program to demonstrate file copy operation using Command Line Arguments.

Text Books:

1. Let Us C by Yashwant Kanetkar
2. Pointers in C by Yashwant Kanetkar

Reference Books:

1. Data Structures Using C & C++ by Rajesh Shukla.
2. Data Structures A Pseudocode Approach with C by Richard F. Gilberg & Behrouz A. Forouzan

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S.Y. B.Tech (Electronics and Telecommunication Engineering) Part-II

ET221: Control Systems

Teaching Scheme:	**Examination Scheme:**
Lecture : 3 Hrs/Week	ISE:30 Marks
Practical : 2 Hrs/Week	ESE:70 Marks
	ICA:25 Marks

- **Course Objectives:**

1. To understand concepts of various control systems.
2. To represent control system using block diagram and signal flow graph and obtain transfer function of system.
3. To obtain stability of control systems.
4. To determine Time domain analysis of control systems.
5. To obtain Frequency domain analysis of control systems.

- **Course Outcomes:**

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

1. Analyze various control systems.
2. Obtain transfer function of systems using signal flow graph and block diagram reduction.
3. Determine stability of systems.
4. Analyze control system in time domain.
5. Analyze control system in frequency domain

SECTION– I

Unit 1: Introduction: [04Hrs]

Types of control systems, examples of control systems: Liquid level control system, position control system, missile launching and guidance system and automatic aircraft landing system. Transfer function of closed loop system.

Unit 2: Mathematical modeling of systems: [05Hrs]

Mathematical modeling of basic mechanical elements: translational and rotational. Mathematical modeling of Electrical systems using R, L and C. Analogous system: force – voltage and Force – current analogy. Transfer function of RLC circuits.

Unit 3: System representation and components: [07Hrs]

Block diagram representation and reduction techniques, Signal Flow Graph- Construction, Mason's Gain formula. Working principle, construction, types and applications of Stepper motor and Tachogenerator.

Unit 4: Stability analysis: [03Hrs]

Concept of stability, absolute and conditional stability, relative stability, Routh – Hurwitz criterion for stability.

SECTION-II

Unit 5: Time response of systems: **[05Hrs]**

Standard test signals, time response of first order systems to step, ramp and impulse input. Step response of second order system, time domain specifications, steady state errors and error constants of type0, type1 and type2 systems.

Unit 6: Root locus: **[04Hrs]**

Concept of root locus, construction of root locus and stability analysis using root locus.

Unit 7: Frequency domain analysis: **[05Hrs]**

Frequency response specifications, co-relation between time domain and frequency domain response, Bode plot: asymptotic bode plot, stability analysis using bode plot.

Unit 8: Compensators: **[03Hrs]**

Need of compensator, types (Lead, Lag & Lead Lag) and their selection.

Internal Continuous Assessment (ICA): - Minimum Ten experiments from the following.

1. To verify potentiometer as transducer and as error detector.
2. To verify Synchro as transducer.
3. To verify Synchro as error detector.
4. To verify operation of AC position control system.
5. To verify operation of DC position control system.
6. To obtain Effect of type of feedback on control system.
7. To obtain Time response of first order system.
8. To obtain Step response of second order system using R, L and C.
9. To obtain Frequency response of second order system using R, L and C.
10. To verify liquid level control system.
11. To obtain frequency response of Lead Lag compensator.
12. To obtain Root locus using MATLAB.
13. To obtain Bode plot using MATLAB.
14. To obtain time response of second order system using MATLAB

- **Text books:**

1. Control Systems Engineering I. J. Nagrath& M Gopal New Age Publication (Fifth Edition)
2. Feedback & Control Systems. Schaum's Outline Series McGraw Hill
3. Automatic Control Systems B. C. Kuo PHI Publication
4. Control Systems Engineering, R. Anandanatrajan,P.Ramesh Babu - Scitech Publication.

- **Reference Books:**

1. Modern Control Engineering K.Ogata Pearson Education
2. Principles of Control Systems S.C. Goyal & U. A. Bakshi Technical Publication, Pune.

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S.Y. B.Tech (Electronics and Telecommunication Engineering) Part-II

ET222: Analog Integrated Circuits

Teaching Scheme:	**Examination Scheme:**
Lecture : 4Hrs/Week	ISE:30 Marks
Practical : 2 Hrs/Week	ESE:70 Marks
	ICA:25 Marks
	POE: 50Marks

Course Objectives:

1. To make student understand principles, configurations and specifications of ideal and practical op amp
2. To make student understand frequency response of op amp
3. To make student understand linear and non linear applications of op amp
4. To enable student design active filters using op amp and analyze waveform generators
5. To introduce to student working of special Linear ICs and its applications

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

1. Describe fundamentals of op amp and compare characteristics of ideal and practical op amp
2. Understand and analyze frequency response of op amp
3. Build various Linear and Nonlinear applications of op amp
4. Design first order and second order filters
5. Understand and describe the concept of special ICs and its applications

SECTION– I

Unit 1: Fundamentals of Operational Amplifier: [08Hrs]

Concept of Differential amplifier- DIBO, AC & DC analysis, opamp fundamentals- block Diagram, equivalent circuit, Transfer curve, Electrical Parameters- practical & Ideal, Open loop configurations, closed loop configurations with negative feedback- Inverting &non inverting.

Unit 2: Practical opamp& frequency response: [08Hrs]

Input offset voltage, Input bias current, Input offset current, total output offset voltage, Thermal drift, PSRR, CMRR, SR & its importance, High frequency equivalent circuit and compensation techniques.

Unit 3: General Linear applications of Opamp: [08Hrs]

Summing, scaling and averaging amplifier, adder-subtractor, Instrumentation Amplifier, V to I and I to V convertors, Op-Amp as differentiator and Integrator including study of frequency response, AC amplifier.

SECTION-II

Unit 4: Non linear applications: **[08Hrs]**

Comparator- Basic, ZCD, Schmitt trigger, window detector, sample& hold circuit, peak detector, precision rectifiers, log-antilog amplifier, clipper & clamper, Peak detector.

Unit 5: Active filters & Oscillators: **[08Hrs]**

Basic filter definitions, Advantages of active filters, First and second order low pass and high pass Butterworth filters, astablemultivibrator, Triangular saw tooth wave generators using Op-Amp, Oscillators- principle, Phase shift, Wien Bridge, Quadrature oscillators.

Unit 6: Special ICS and its applications: **[08Hrs]**

Voltage regulators- 78xx,79xx, LM317, 723,basic switching regulator IC 555 Timer- basic, astable, monostable, PLL 565- operating principle, block diagram, IC 565, Applications of PLL as frequency multiplier and FSK demodulator, IC 8038.

Internal Continuous Assessment (ICA): ICA should be based on minimum eight experiments from the following list of experiments.

Experiments: -

1. Measurement of parameters – Vio, Iio, IB etc
2. Op-Amp as Inverting and Non-inverting amplifier, Voltage follower.
3. Frequency response of Inverting and Non-inverting amplifiers.
4. Implementation of Op-Amp as adder and subtractor.
5. Op-Amp as Integrator and Differentiator.
6. Op-Amp as Schmitt trigger.
7. Op-Amp as window detector.
8. Op-Amp as peak detector.
9. Op-Amp as waveform generators (Square, triangular, Saw tooth)
10. RC oscillator.
11. Op-Amp as Precision rectifier.
12. Phase Lock Loop 565.
13. Op-Amp as Clippers and Clampers.
14. V to I convertor with grounded load.
15. Implementation of first and second order low pass Butterworth filer.
16. Implementation of first and second order high pass Butterworth filer.

Note: Simulate results using simulation software for at least two experiments.

- **Text books:**

1. Op-Amps and Linear Integrated Circuits, Ramakant A. Gaikwad, PHI Learning Pvt. Ltd.,Third and Fourth edition
2. Linear Integrated Circuits, D. Roy Choudhary, Shail B. Jain, New age InternationalPublishers, Third edition

- **Reference Books:**

1. Operational Amplifiers, G.B. Clayton, English Language Book Society, Second edition
2. Operational amplifiers and Linear ICS by David Bell, oxford university press, 3rd edition
3. Linear Integrated circuits by S Salivahanan, Tata McGraw hill
4. Integrated Circuits by K R Botkar, Khanna Publication

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S.Y. B.Tech (Electronics and Telecommunication Engineering) Part-II

ET223: Principles Of Digital Communication

Teaching Scheme:	**Examination Scheme:**
Lecture : 4Hrs/Week	ISE:30 Marks
Practical : 2 Hrs/Week	ESE:70 Marks
	ICA:25 Marks
	POE: 25Marks

Course Objectives:

1. To make student understand the significance of information theory, entropy coding, block coding techniques in communication system.
2. To introduce student basic components of digital communication system for different pulse, binary and M-ary digital modulation schemes with their performance analysis.
3. To explain various synchronizing techniques as well as coherent and non- coherent type of receivers used for demodulation techniques.
4. To introduce the concept and significance of multichannel and multicarrier system.
5. To introduce the concept and significance of Error Control Codes.

Course Outcomes:

1. Student will be able to explain, solve, and evaluate problems related to information theory, entropy coding and block coding techniques.
2. Student will be able to describe uniform and non-uniform quantization technique, design block diagram level digital communication system using PCM, DPCM, ADPCM, DM, ADM, binary and M-ary ASK, FSK, PSK, DPSK, QAM, MSK techniques, compare them and calculate the bandwidth requirement for different systems using PCM techniques
3. Student will be able to explain different bit and frame synchronization methods, coherent / non-coherent types of receivers used.
4. Student will be able to explain the concept and significance of multichannel and multicarrier system.
5. Student will be able to explain the concept and significance of Error Control Codes.

SECTION - I

Unit 1–Random and Information Theory **No of lectures – 08**

Introduction to information theory, average and mutual information, Entropy, Joint Entropy and conditional entropy, Rate of information, redundancy, channel capacity, Shannon's Theorem, Shannon – Hartley theorem, bandwidth, S/N trade off, entropy coding- Shannon Fano Coding, Huffman Coding

Unit 2–Pulse Code Modulation Techniques **No of lectures – 06**

Basic block diagram of digital communication system, Quantization – Uniform & Non uniform,
Types of digital modulation system- PCM System, Differential PCM, TDM-PCM Telephone system, ADPCM, Delta Modulation – Noise in DM, ADM.

Unit 3–Binary Digital Modulations Techniques **No of lectures – 06**

Line Coder-Unipolar, Polar, AMI, Manchester. Binary ASK, FSK, PSK, DPSK Coherent and non-coherent Detection. Probability of error, Comparison of digital modulation schemes–Bandwidth, power requirements& Equipment complexity.

SECTION – II

Unit 4– M-ary Digital Modulations Techniques **No of lectures – 06**

QPSK concept and transmitter/Receiver, M–ary concept ,Types of M-ary , M-ary differential PSK transmitter and Receiver, M-ary wideband FSK, structure of the receiver for an orthogonal (widebabd FSK) signaling scheme, QAM modulation and demodulation, Minimum shift keying transmitter and receiver.

Unit 5–Optimum receiver for digital Modulation **No of lectures – 06**

Matched filter receiver, Correlation receiver, Synchronization- Symbol Synchronization, Frame synchronization, Carrier recovery circuits.

Unit 6–Multichannel and Multicarrier systems **No of lectures – 06**

Multichannel Digital Communication in AWGN channels, multicarrier Communication System,
FFT Based multicarrier system, Minimizing Peak-to-average ratio in multicarrier system.

Unit 7–Error Control Codes **No of lectures – 06**

Introduction to linear block code, linear block code examples, generator matrix, systematic linear block codes, Parity-check matrix, Syndrome testing, Error correction, Decoder implementation.

Internal Continuous Assessment:

ICA consists of Minimum 10 experiments performed out of which at least 4 experiments must be using MATLAB / Scilab)

List of Practicals

1. PCM
2. DPCM /ADCM
3. PCM -TDM
4. Data Formats
5. Companding
6. DM
7. ADM
8. ASK
9. FSK
10. PSK
11. DPSK
12. QPSK
13. MATLAB Based Experiment.

Text Books:

1. Communication System Analog & Digital - Singh &Sapre.-TMH.
2. Digital Communication System Design – M.S. Roden.-PHI
3. Digital Communication -John G. Proakis- Pearson Education
4. Communication Systems (Analog and Digital) – Sanjay Sharma – Katsons

Reference Books:

1. Principles of Communication System – Taub & Schling-TMH
2. Digital & Analog Communication systems – K. Sam Shanmugan-Wiley
3. Digital communication Fundamentals and Applications–2nd edition by Bernard Sklar Pearson Education.
4. Contemporary Communication system using MATLAB by John G. Proakis, M AsonidSalehi, GenhardBauch.

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(Electronics and Telecommunication Engineering) Part-II

ET224: Signals and Systems

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week	ISE:30 Marks
Tutorial : 1Hrs/Week	ESE:70 Marks
	ICA:25 Marks

- **Course Objectives:**

1. To understand the fundamental characteristics of signals and systems
2. To develop of the mathematical skills to solve problems involving convolution and sampling.
3. To represent and realize LTI System by differential and difference Equations.
4. To understand the concept of Fourier Transform and its applications.
5. To understand the concept of Z transform with ROC

- **Course Outcomes:**

On completion of this course student will able to

1. Represent different signals and systems mathematically and able to Characterize their behavior graphically.
2. Solve numerical on convolution integral, Convolution sum and Sampling theorem
3. Realize LTI system equations by using different forms
4. Calculate Fourier transform and able to with plot of Amplitude and Phase spectrum
5. Calculate ZT of a function , Plot its ROC

SECTION– I

Unit 1: Signals and Systems: [09Hrs]

Introduction to signal and systems, Types of Signals, Elementary Continuous time and discrete time Signals, Transformations of independent Variable, Classification of Signals, Properties ofSystem.

Unit 2: Continuous Time (CT) systems: [05Hrs]

Introduction, The Representation of Signals in Terms of Impulses, Convolution integral, Block Diagram representation of LTI Systems described by Differential Equations.

Unit 3: Discrete Time (DT) system: [04Hrs]

The Representation of Signals in Terms of Impulses, Convolution Sum, and Block diagram Representation of LTI Systems described by Difference Equations, Interconnections of systems.

SECTION-II

Unit 4: Sampling: **[04Hrs]**

Introduction, Representation of a Continuous- Time Signal by Its Samples, The Sampling Theorem, Reconstruction of a signal from its Samples using different methods (Interpolation, Zero order hold, low pass filter), The Effect of Under-sampling (Aliasing).

Unit 5: Fourier Analysis for Continuous-Time Signals and Systems: **[08Hrs]**

Introduction, The Response of LTI Systems to Complex Exponentials, Fourier series Representation of Continuous-Time Periodic signals, Convergence of Fourier Series, Representation of Aperiodic Signals: The Continuous -Time Fourier Transform, Properties of Fourier Transform, Application of Fourier Transform in LTI systems.

Unit 6: Z-Transform: **[06Hrs]**

Introduction, The Z-Transform, The Region of Convergence for the Z-Transform, Properties of Z Transform, The Inverse z-Transform (IZT)(Power Series method and Partial Fraction Expansion Method), Application and Characteristics of LTI System Using Z Transform

Internal Continuous Assessment (ICA):

Tutorials: -

Minimum any eight tutorials from the following.

1. Numerical on transformations of independent variable (Including Operations like Inversion, Amplitude scaling)
2. Numerical on classification of signals
3. Numerical on properties of systems
4. Numerical on convolution integral
5. Numerical on Convolution sum
6. Numerical on sampling theorem
7. Derivation and theory on sampling theorem, under sampling and methods of reconstruction of signals
8. Numerical on Fourier series including its amplitude and phase spectrum.
9. Numerical Fourier transforms including its amplitude and phase spectrum.
10. Numerical on ZT calculation with ROC plot and IZT

- **Text books:**

1. Signals and Systems A.V. Oppenheim and A. S. Wilsky, 2nd edition [Pearson Education]
2. Signals and Systems Simon Haykin and Barry Van Veen, 2nd edition [Wiley and Sons]
3. Signals and Systems, I. Ravi Kumar, PHI

- **Reference Books:**

1. Signals and Systems Dr.S.Palani [Ane Books Pvt Ltd, New Delhi]
2. Signals and Systems by V. Krishnaveni and A. Rajeswari [Wiley India]
3. Signals and Systems by P. Ramesh Babu and R. Anand Natarajan [Scitech]

Punyashlok Ahilyadevi Holkar Solapur University, Solapur S.Y. B.Tech
(Electronics and Telecommunication Engineering) Part-II

ET225: Data Structure

Teaching Scheme:	**Examination Scheme:**
Lecture : 4 Hrs/Week	ISE:30 Marks
Practical : 2 Hrs/Week	ESE:70 Marks
	ICA:25 Marks
	POE: 50Marks

- **Course Objectives:**

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures

- **Course Outcomes:**

Upon completion of this course, students will be able to do the following:

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

SECTION– I

Unit 1: Introduction: [08Hrs]

Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Unit 2: Stacks: [09Hrs]

ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation (converting infix to postfix expression using algorithm, evaluating postfix expression using algorithm, recursive flow chart, programs using recursive functions - factorial, Fibonacci sequence). and complexity analysis.

Unit 3: Queues: [07Hrs]

ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

SECTION-II

Unit 4: Linked Lists: **[9Hrs]**

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Unit 5: Trees: **[07Hrs]**

Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Unit 6: Sorting and Hashing: **[08Hrs]**

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Internal Continuous Assessment (ICA):

Students should perform minimum twelve practicals based on the following preferably conducted on Unix / Linux platform

Practicals: -

Minimum twelve practicals from the following.

1. Implementation of stack using array.
2. Implementation of Queue using array.
3. Implementation of circular Queue using array.
4. Implementation of stack using Linked list.
5. Implementation of Queue using Linked list.
6. Implementation of Circular Queue using Linked list.
7. Implementation of singly Linked list.
8. Implementation of Josephus problem using Circular Linked list.
9. Find Factorial of a given no, by defining recursive function.
10. Fibonacci sequence implementation using recursive function.
11. Search element from list using linear search and Binary search method.
12. Write the program to Sort the given list using Bubble sort method
13. Write the program to Sort the given list using Selection sort method
14. Write a program to Sort the given list using Insertion sort method

- **Text books:**

1. Data Structures Using C and C++, Y.Langsam, M.J. Augenstein, A.M Tanenbaum Pearson Education Second Edition
2. Data structures using C, Rajani Jindal Umesh Publication
3. Data structures through C in Depth, S.K.Srivastava, Deepali Srivastava, BPB Publication.
4. Data Structures using C, ISRD Group, TMH
5. Data Structures- Venkatesan, Wiley Publication.

- **Reference Books:**

1. Fundamentals of Data Structures, Ellis Horowitz, SartajSahni (Galgotia Book Source).
2. Data Structures and Program design, Robert L. Kruse (PHI).
3. Data structure and algorithm, mark Allen Weiss (Pearson Publication, Second edition).
4. Data Structures using C and C++, Rajesh K. Shukla, Wiley Precise.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur S.Y. B.Tech
(Electronics and Telecommunication Engineering) Part-I

ET226: Electronic Software Lab-II

Teaching Scheme:
Tutorial :1Hrs/Week
Practical :2Hr/Week

Examination Scheme:
ICA:50 Marks

Course Objectives:
1. To develop fundamentals of simulation software for simulation of different linear, non-linear electronic applications
2. To understand the concept of MATLAB software and its signal processing toolbox.
3. To understand PCB Designing process and implement design using PCB design software.

Course Outcomes:
1. Students will be able to use electronic circuit design software.
2. Students will able to use signal processing toolbox for signal processing application.
3. Students will design PCB using PCB designing software which is the production domain for various small firmwares.

Course Prerequisite: Basics of Passive and active components and MATLAB software.

Unit 1: **Circuit Simulation**
Simulation of Electronic Circuits studied in ECAD-II using Simulation software like Orcad Capture 9.2, Proteus, Multisim etc.

Unit 2: MATLAB simulation
Introduction to MATLAB, Signal Processing Toolbox

Unit 3: PCB Design
Design of Single sided PCB using PCB Design Software like Orcad, Eagle etc

Internal Continuous Assessment (ICA):
Minimum six experiments:

1) Voltage series feedback amplifier/ RC Phase shift oscillator.
2) Two stage amplifier
3) V-I characteristics of JFET.
4) Working with Arithmetic, Exponential, logarithmic, Trigonometric operation in Matlab.
5) Working with Matrix, Vectors and arrays.
6) Plot of Basic test Signals using plot, stem, fplot, and subplot.
7) Program for Sampling Theorem using Matlab
8) Program for finding Z transform using Matlab.
9) Design of single sided PCB using Eagle Cad.
10) Any additional experiments based on syllabus.

Note: POE for Electronic Circuit Analysis and Design – II and Electronics Software lab-II is Combined.

Text Books:

1. Getting Started with MATLAB – Rudra Pratap
2. Mastering MATLAB 7 – Hanselman, Pearson Education
3. Modelling and Simulation using MATLAB Simulink – Dr. Jain Shailendra, Wiley India