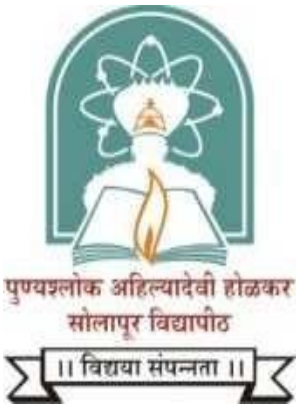
Punyashlok Ahilyadevi Holkar Solapur University,Solapur



NAAC Accredited-2015'B'Grade(CGPA2.62)

Name of the Faculty: Science&Technology

Choice Based Credit System

ELECTRONICS & TELECOMMUNICATION ENGINEERING

Syllabus Structure for

S.Y. B.Tech (Electronics & Telecommunication Engineering) w.e.f.

Academic Year 2021-22

T.Y. B.Tech (Electronics & Telecommunication Engineering) w.e.f.

Academic Year 2022-23

Final Year B.Tech (Electronics & Telecommunication Engineering) w.e.f. Academic Year 2023-24

PUNYASHLOK AHILYADEVI HOLKARSOLAPUR 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 & allied fields.
2. To build strong fundamental knowledge amongst student to pursue higher education and continue professional development in Electronics & other 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 to ethical, societal & environmental issues while conducting their professional work.

B. Program Outcomes

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

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FACULTY OF SCIENCE & TECHNOLOGY

Credit System structure of S.Y. 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***
ET211	Engineering Mathematics – III	3	1	--	4	30	70	25	125
ET212	Electronic Circuit Analysis and Design	3	--	--	3	30	70	25	125
ET213	Network Theory and Analysis	3	--	--	3	30	70	--	100
ET214	Digital Techniques	3	--	--	3	30	70	25	125
ET215	Analog Communication	3	--	--	3	30	70	25	125
Sub Total		15	1	--	16	150	350	100	600
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	--	--	--	25	25
ET214	Digital Techniques	--	--	2	1	--	25	--	--	25
ET215	Analog Communication	--	--	2	1	--	25	--	--	25
E216	Electronics Software Lab-I	--	1	2	2	--	--	--	25	25
Sub Total		--	1	10	6	--	100		50	150
Grand Total		**15**	**2**	**10**	**22**	**150**	**450**		**150**	**750**

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, ESE - University Examination (Theory &/ POE &/Oral examination)

 Note: *- Practical and Oral Examination of Electronics Circuit Analysis and Design include some of the practical from Network Theory and Analysis

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FACULTY OF SCIENCE & TECHNOLOGY

Credit System structure of S.Y. 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***
ET221	Control System	3	1	_	4	30	70	25	125
ET222	Analog Integrated Circuits	3	_	_	3	30	70	25	125
ET223	Principles of Digital Communication	3	--	--	3	30	70	25	125
ET224	Signals and Systems	3	1	_	4	30	70	25	125
ET225	Data Structures	3	_	_	3	30	70	--	100
Sub Total		15	2	--	17	150	350	100	600
ENV22	Environmental Science	1	-	--	--	--	--	--	--
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET222	Analog Integrated Circuits	_	_	2	1	_	25	_	--	25
ET223	Principles of Digital Communication	--	--	2	1	--	25	--	--	25
ET225	Data Structures	_	_	2	1	--	--	--	25	25
ET226	Electronic Software Lab-II	1	--	4	3	_	50	--	25	75
Sub Total		--	--	10	6	--	100		50	150
Grand Total		**16**	**2**	**10**	**23**	**150**	**450**		**150**	**750**

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, ESE - University Examination (Theory &/ POE &/Oral examination).

 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 18 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-I but before Final Year Part-I & the report shall be submitted and evaluated in Final Year Part-I.
4. 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.

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FACULTY OF SCIENCE & TECHNOLOGY

Credit System structure of T.Y. B.Tech. Electronics & Telecommunication Engineering ***W.E.F. 2022-23***

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	Microcontrollers and Applications	3	--	--	3	30	70	25	125
ET313	Digital Signal Processing	3	-	--	3	30	70	25	125
ET314	Open Elective-I	3	1	--	4	30	70	25	125
SLM31	Self Learning Module–I(HSS Course)	--	--	--	2	--	50	--	50
Sub Total		12	2	--	16	120	330	100	550
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET312	Microcontrollers and Applications	--	--	2	1	--	50	--	--	50
ET313	Digital Signal Processing	--	--	2	1	--	50	--	--	50
ET315	Electronic Software Lab-III	1	--	4	3	--	50	--	50	100
Sub Total		--	--	8	5	--	150		50	200
Grand Total		**13**	**2**	**8**	**21**	**120**	**480**		**150**	**750**

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PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

Credit System structure of T.Y. B.Tech..Electronics& Telecommunication Engineering ***W.E.F. 2022-23***

Semester II

Course Code	***Theory Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
ET321	Antenna & Wave Propagation	3	1	--	4	30	70	25	125
ET322	Embedded System	3	--	--	3	30	70	25	125
ET323	Electronic System Design	3	--	--	3	30	70	25	125
ET324	Professional Elective-I	3	--	--	3	30	70	--	100
ET325	Open Elective-II	3	--	--	3	30	70	--	100
Sub Total		15	1	--	16	150	350	75	575
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET322	Embedded System	--	--	2	1	--	25	--	--	25
ET323	Electronic System Design	--	--	2	1	--	50	--	--	50
ET324	Professional Elective-I	--	--	2	1	--	--	--	25	25
ET325	Open Elective-II	--	--	2	1	--	--	--	25	25
ET327	Mini Project	--	--	2	1	--	--	25	25	50
Sub Total		--	--	10	5	--	100		75	175
Grand Total		**15**	**1**	**10**	**21**	**150**	**450**		**150**	**750**

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, ESE - University Examination (Theory &/ POE &/Oral examination).

 Note –

1. Batch size for the practical /tutorial shall be of 16 students. On forming the batches, if the strength of remaining student exceeds 8, 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-I but before Final Year Part-I & the report shall be submitted and evaluated in Final Year Part-I.

3. Self-Learning Module I at T.Y. B.Tech.– Semester I

   - Student shall select & enroll a Self Learning Module I Course from PAH Solapur University, Solapur HSS Course List (SLM31). Student must appear and pass university examination.
   - Curriculum for Humanities and Social Sciences (HSS), Self Learning Module-I is common for all undergraduate engineering programs.
   - Minimum four assignments for Self Learning Module (SLM31) shall be submitted by the students which shall be evaluated by a Module Coordinator assigned by institute/department.

   OR

   - Student shall select and enroll for university approved minimum eight weeks MOOC based HSS course (SLM31), and complete its assignments. Student must appear and pass certificate examination conducted through MOOC courses.

4. Open Elective I & II shall be common and open for the students of the branches – Electronics Engineering, Electronics & Telecommunication Engineering and Electrical Engineering. Students of these branches can take any of these Open Electives. Syllabus and university examination question paper will be same for all these branches.

5. Student shall select Professional Elective-I from given course list. Student must appear and pass university examination.

6. Project group for T.Y. B.Tech. - Semester II – Mini Project shall not be of more than three students. This mini project may include simulation and/or Software and/or Hardware. Report of this work should be submitted at the end of semester.

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

- **List of Open Electives -**

Sr.	Branch Offering Elective	Open Elective I	Open Elective II
1.	Electronics &Telecommunication Engineering	1. Managerial Economics 2. Project Management and Operation Research	1. Sensors and Applications 2. Open Source Technologies
2.	Electronics Engineering	Information Technology & Management	Operating Systems
3.	Electrical Engineering	Business Ethics	Power System Planning

- **List of Professional Elective I–**
  1. Optical Fiber Communication
  2. Image and Video Processing
  3. Multimedia Communication Technology
- **List of Self Learning Modules (HSS Course) (SLM 31)–**

  1. MOOC/University Defined Courses

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

Credit System structure of Final Year B.Tech. Electronics & TelecommunicationEngineering W.E.F. 2023-24

Semester I

Course Code	***Theory Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
ET411	Microwave Engineering	3	--	--	3	30	70	25	125
ET412	Data Communication	3	--	--	3	30	70	25	125
ET413	VLSI Design	3	--	--	3	30	70	25	125
ET414	Professional Elective-II	3	1	--	4	30	70	25	125
ET415	Research Methodology	3	--	--	3	30	70	25	125
Sub Total		15	1	--	16	150	350	125	625
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET411	Microwave Engineering	--	--	2	1	--	--	25	--	25
ET412	Data Communication	--	--	2	1	--	25	--	--	25
ET413	VLSI Design	--	--	2	1	--	25	--	--	25
ET416	Project Phase-I	_	_	4	2	_	_	--	25	25
ET417	Vocational Training	--	--	--	1	--	--	--	25	25
Sub Total		--	-	10	6	--	75		50	125
Grand Total		**15**	**1**	**10**	**22**	**150**	**425**		**175**	**750**

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, ESE - University Examination (Theory &/ POE &/Oral examination)

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

Credit System structure of Final Year B.Tech. Electronics & Telecommunication Engineering ***W.E.F. 2023-24***

Semester II

Course Code	***Theory Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
ET421	Professional Elective-III	--	--	--	2	--	50	--	50
SLM41	Self Learning Module–II (Professional Course)	--	--	--	2	--	50	--	50
Sub Total		--	--	--	4	--	100	--	100
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET421	Project Phase-II (Capstone Project / Internship)	--	--	20	10	--	--	100	100	200
Sub Total		--	--	--	10	--	100	100	200
Grand Total			**-**	**20**	**14**	**--**	**200**	**150**	**300**

Note –

1. Batch size for the practical /tutorial shall be of 15 students. On forming the batches, if the strength of remaining students exceeds 8, 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-I but before Final Year Part-I & the report shall be submitted and evaluated in Final Year Part-I.
3. Project group for Final Year (Electronics & Telecommunication Engineering) Part I and Part II shall not be of more than **three** students.
4. 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.

5. Self-Learning Module II at Final Year B.Tech. – Semester II

   - Student shall select a Self Learning Module II (Professional Course) from Course List (SLM 41). Student must appear and pass university examination.
   - Minimum four assignments for Self Learning Modules (SLM 41) shall be submitted by the students which shall be evaluated by a Module Coordinator assigned by institute / department.

   OR

   - Student can select & enroll for university approved minimum eight week technical course from various MOOC technical courses, and complete its assignments. Student must appear and pass certificate examination conducted by MOOC courses.

6. Student shall select Professional Elective-II and III from course list. Student must appear and pass university examination.

7. In Project phase-I students shall select Sponsored / Industry oriented / In –House projects which should cover Literature survey, Problem statement finalization, and Synopsis submission of proposed work. Student shall submit hard copy of synopsis only after delivering seminar.

8. Project phase-II can be Capstone project/Internship which shall be the implementation of the problem statement decided as in phase-I. A hard copy of the final report shall be submitted to the department after successfully completion of project

   - Student can carry out project phase II as sponsored/In House project

   OR

   - Student can avail semester long internship/ apprentice/ industrial training and the report submitted by student will be accepted as the project work only if, project guide accepts this work and examination panel approves the same. (Student should continuously report their work to the project guide and should be periodically evaluated by the internal examiners at college level)

- **List of Professional courses–**

Sr. No	B.Tech part I Professional Elective-II	B.Tech part II Professional Elective-III
1	PLC and Industrial Controllers	Wireless Sensor Networks
2	Mobile Communication	Satellite Communication
3	DSP Processor and application	Software Defined Radio

- **Self Learning Module-II**
  1. Electric Vehicles
  2. Mechatronics
  3. Biomedical Instrumentation
  4. MOOC / University Defined Courses

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Credit System structure of S. Y. B. Tech. (Electronics & Telecommunication Engineering) Part-I w.e.f. 2021-2022

ET211 – Engineering Mathematics - III

Teaching Scheme:
Lecture:3 hr/week, 3 credits
Tutorial: 1 hr/week, 1 credit

Examination Scheme:
ESE : 70 Marks
ISE : 30 Marks
ICA : 25 Marks

Course Objective:

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 introduce numerical methods for solving linear equations and for evaluating the definite integrals.
6. To introduce to student Fourier Transform.

Course Outcomes: At the end of this course, student will be able to –

1. Solve higher order linear differential equation related to electrical circuit theory
2. Express a function in terms of sines and cosines components so as to model simple periodic functions
3. Find the relation between two variables for the given data using regression and can explain various probability distribution functions.
4. Apply Laplace and inverse Laplace transforms for analysis of simple electrical circuits.
5. Apply numerical methods for solving linear equations and for evaluating the definite integrals.
6. 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, Shortcut methods for standard functions like$e^{ax}, \sin(ax+b), \cos(ax+b), x^m, e^{ax}v, x, v$ particular integral bygeneral 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 2π 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: [09Hrs]

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: Linearity property, first shifting theorem, partial fraction, inverse transform of logarithmic &inverse trigonometric functions and convolution theorem, solution of differential equations by Laplace transform.

Unit5: Solution of Algebraic and Transcendental Equations and Numerical Integration: [06Hr]

Introduction, Basic properties of equations, False position Method, Newton-Raphson Method, Numerical Integration using Newton's Cote's Formulae-Trapezoidal rule, Simpson's 1\3rd rule, Simpson's 3/8th rule, Gaussian Quadrature two point and three-point formulae.

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. Numerical Methods, Dr. P. Kandasamy, Dr. K. Thilangavathy, Dr. K. Gunavathi, S. Chand Publication, New Delhi.
5. A Textbook of Applied Mathematics, N.P. Bali, Ashok Saxena and N.Ch. S.N. IyengarLaxmi Publications, Delhi.
6. 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 UniversityPress

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Credit System structure of S. Y. B. Tech. (Electronics & Telecommunication Engineering) Part-I w.e.f. 2021-2022

ET212 – Electronic Circuit Analysis and Design

Teaching Scheme:
Lecture: 3 hr/week, 3 credits
Practical : 2hr/week, 1 credit

Examination Scheme:
ESE : 70 Marks
ISE : 30 Marks
ICA : 25 Marks
POE : 50* Marks

Course Objectives:

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

Course Outcomes: At the end of this course, student will be able to –

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

SECTION– I

Unit 1: Bipolar Junction Transistor [8Hrs]

Introduction, Construction and working, BJT characteristics and its configuration, Load Line analysis, BJT Biasing, BJT as CE amplifier, h-model of BJT, Design of single stage CE amplifier.

Unit 2: Multistage Transistor Amplifiers: [5Hrs]

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

Unit3: 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. Design of Two stage RC coupled amplifier with voltage series feedback.

SECTION-II

Unit 4: Oscillators: **[07Hrs]**

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 oscillator.

Unit 5: Power Amplifiers: **[07Hrs]**

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.

Unit 6: Field Effect Transistor: **[07Hrs]**

Introduction, Construction and working, JFET characteristics (Transfer and Drain), Schockley's equation, JFET biasing and DC analysis, JFET as CS amplifier, MOSFET-Construction, working & V-I characteristics(finite output resistance, body effect, break down effect, temperature effect, short channel effects),CMOS.

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

Internal Continuous Assessment (ICA):

List of 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. RC Phase shift oscillator.
4. Wein Bridge oscillator.
5. Analysis of Class A power amplifier
6. Analysis Class B push pull Amplifier
7. V-I characteristics of JFET.
8. V-I Characteristics of MOSFET
9. Application of MOSFET as a switch.
10. Implement JFET/MOSFET CS Amplifier and calculate Av, Ri and Ro.
11. Simulate two stage RC coupled CE amplifier with feedback
12. Simulate LC oscillator
13. 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

Credit System structure of S. Y. B. Tech. (Electronics & Telecommunication Engineering) Part-I w.e.f. 2021-2022

ET213 – Network Theory & Analysis

Teaching Scheme:
Lecture: 3 hr/week, 3 credits
Practical : 2 hr/week, 1 credit

Examination Scheme:
ESE : 70 Marks
ISE : 30 Marks
ICA : 25 Marks

Course Objectives:

1. To develop skills for analysis of linear circuits with dependent and independent 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: At the end of this course, student will be able to –

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:

- KVL, KCL, star-delta transformation, Mesh and Nodal Analysis

SECTION I

Unit 1: Circuit Analysis and Network Theorems: [08Hrs]

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

Unit 2: Resonance: [05Hrs]

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.

Parallel resonance**:** Parallel resonant circuit (Tank circuit), resonant frequency, and variation of Impedance 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 port networks, T and π representation, Terminated 2 port networks.

SECTION II

Unit 4: Transient Response: **[08Hrs]**

Review of Laplace Transform Basics: Initial conditions,

Evaluation and analysis of transient and steady state response of following:

RL circuit: DC voltage and current response.

RC circuit: DC voltage and current response

RLC circuit: DC voltage and current response.

Unit 5: Network Function: **[05Hrs]**

Complex frequency: Concept of complex frequency.

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

Unit 6: Filters and attenuators: **[08Hrs]**

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 Neper and Decibels, Design of T, π and Lattice attenuators.

Internal Continuous Assessment (ICA):

Note:

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 Thevenin's theorem.
3. Verification of Maximum Power Transfer Theorems.
4. Frequency response of series resonance circuit.
5. Step response of RL circuit (Transient and steady state).
6. Step response of RC circuit (Transient and steady state).
7. Verification of Z and Y parameters.
8. Verification of H parameters.
9. Design LPF, plot frequency response and find cut off frequency.
10. Design HPF, plot frequency response and find cut off frequency.

11. Design and verification of T-type attenuators.
12. Design and verification of π-type attenuator.
13. Design and verification of Lattice type attenuator.

Text books:

1. Circuit and network analysis and synthesis by A Sudhakar and Sham Mohan S Palli. TMH publication. 3rd Edition
2. Electric circuit analysis by Ramesh Babu, Scientech Publication
3. Electrical ntework by Ravish Singh, TATA McGraw-Hill
4. Circuit Theory (Analysis and Synthesis) A. Chakrabarti DhanpatRai and Co. 6th Edition.
5. Network Analysis & Synthesis- Franklin Kuo, Wiley Publication.
6. 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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ET214 – Digital Techniques

Teaching Scheme:
Lecture: 3 hr/week, 3 credits
Practical : 2 hr/week, 1 credit

Examination Scheme:
ESE : 70 Marks
ISE : 30 Marks
ICA : 25 Marks
POE : 25 Marks

Course Objectives:

1. To demonstrate the use of codes and k-map minimization, Quine-McClusky techniques in digital circuits.
2. To design combinational logic circuits using logic gates.
3. To illustrate the use and significance of logic IC families and flip-flops in digital circuits.
4. To design asynchronous and synchronous sequential logic circuits.
5. ET214.5: To apply concepts of synchronous state machines for designing digital applications.

Course Outcomes: At the end of this course, student will be able to –

1. Demonstrate the use of codes and k-map minimization, Quine-McClusky techniques in digital circuits.
2. Design combinational logic circuits using logic gates.
3. Illustrate the use and significance of logic IC families and flip-flops in digital circuits.
4. Design asynchronous and synchronous sequential logic circuits.
5. Apply concepts of synchronous state machines for designing digital applications.

SECTION– I

Unit 1: Codes and Simplification technique: [06Hrs]

Codes- BCD and Gray codes, sevensegment, Principles of combinational logic: Standard representation for Logical Function, canonical forms, don't care conditions, minimization techniques using Karnaugh map up to 4 variables only, Quine-McClusky technique, hazards and hazard free circuit.

Unit 2: Combinational Circuit Design: [07Hrs]

Binary Adder, Subtractor, Decimal digit BCD adder, 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.

Unit 3: Logic Families and flip flop: **[08Hrs]**

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: **[07Hrs]**

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,

Unit 6:State machines: **[07Hrs]**

Moore and Mealy machines, representation techniques, state diagram, state assignment, state reduction, implementation using flip flops.

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
5. Verification of 4 bit digital comparator using IC 7485.
6. Design and implementation of 1 decimal digit BCD adder using IC 7483.
7. (i) Verification of functionality of multiplexer.
   (ii) Design and implement combinational logic function using multiplexer ICs.
8. (i) Verification of functionality of decoder.
   (ii) Design and implement combinational logic function using decoder IC.
9. Verification of the functionality of BCD to Seven segment decoder/driver.
10. Implement S-R, D, J-K, T flip flops using logic gates.
11. Functional verification of universal shift registers using IC 7495.
12. Design and implementation of Ring counter using shift register.
13. Design and implementation of Johnson counter using shift register.
14. Design and implementation of Pulse train generator using IC 7495.
15. Functional verification of ripple counter using IC 7490

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. 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 (3rd Edition),Oxford Press.

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ET215 – Analog Communication

Teaching Scheme:
Lecture: 3 hr/week, 3 credits
Practical : 2 hr/week, 1 credit

Examination Scheme:
ESE : 70 Marks
ISE : 30 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:

At the end of this 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: **[6Hrs]**

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, Application of communication.

Unit 2: Noise **[7Hrs]**

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.

Unit 3: AM Transmission: **[8Hrs]**

Block Diagram of AM Transmitter, Modulation Index, Generation of AM (DSBFC) and its spectrum. Power relations applied to sinusoidal signals, DSBSC – multiplier modulator, Nonlinear generation, switching modulator, Ring modulator & its spectrum,. SSBSC, ISB & VSB, their generation methods & Comparison, Behavior of Baseband systems and Amplitude modulated systems i.e. DSBSC and SSBSC in presence of noise and Broadcast technical standards.

SECTION-II

Unit 4: AM Reception: **[7Hrs]**

Block diagram of TRF AM Receivers, Super Heterodyne Receiver, Dual Conversion Super heterodyne Receiver. 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: **[8Hrs]**

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, Ratio Detector.

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

Sampling Theorem, Proof of Sampling Theorem, Nyquist Rate and Nyquist Interval, Sampling Techniques - Natural sampling, Flat Top Sampling, Comparison of Various Sampling Techniques, Concept of multiplexing (TDM and FDM).Analog Pulse Modulation/Demodulation Methods- Pulse Amplitude Modulation, Pulse Time Modulation

ICA List of Experiments for Analog Communication

Perform any 8 experiments from following List of Practical out of this two must be using software.

1. AM Generation (DSB-FC): Calculation of modulation index by graphical method, Power of AM Wave for different modulating signal.
2. AM detection using 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. Frequency modulator & demodulator, calculation of modulation index & BW ofFM into time domain & frequency domain.
5. Study of AM & FM Spectrum: Observe Spectrum of AM & FM, Compare & comment on AM & FM spectrum.
6. Verification of Sampling Theorem, PAM Techniques, (Flat top & Natural sampling), reconstruction of original signal, Observe Aliasing Effect in frequency domain.
7. PWM Technique & reconstruction of original signal.
8. PPM Technique & reconstruction of original signal.
9. Generate AM signal using suitable software.
10. Generate AM with noise using suitable software.
11. Generate FM signal using suitable software.

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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ET216 – Electronic Software Lab-I

Teaching Scheme:
Tutorial: 1 hr/week 1 credit
Practical : 2 hr/week, 1 credits

Examination Scheme:
ICA : 25 Marks

Course Objectives

1. To study and implement advanced features of C++ programming language.
2. To study and implement basics of Python programming language.

Course Outcome: At the end of this course, student will be able to –

1. Implement functions using C++.
2. Implement Inheritance and Polymorphism using C++.
3. Use functions and modules using Python.

Course Prerequisite: Basic C programming and logical computation.

SECTION-I

Unit 1: Introduction **[2 Hrs]**

Need of Object-Oriented Programming (OOP), Object Oriented Programming Paradigm, Basic Concepts of Object-Oriented Programming, Benefits of OOP, C++ as object oriented programming language.

Unit 2: C++ Programming **[3 Hrs]**

C++ programming Basics, Data Types, Structures, Enumerations, control structures, Arrays and Strings, Class, Object, class and data abstraction, class scope and accessing class members, separating interface from implementation, controlling access to members.

Unit 3: Functions **[3 Hrs]**

Function, function prototype, accessing function and utility function, Constructors and destructors, Objects and Memory requirements, Static Class members, data abstraction and information hiding, inline function, Operator Overloading.

SECTION II

Unit 4: Inheritance and Polymorphism **[3 Hrs]**

Inheritance - Base Class and derived Class, protected members, relationship between base Class and derived Class, Constructor and destructor in Derived Class, Overriding Member Functions, Class Hierarchies, Inheritance, Public and Private Inheritance, Levels of Inheritance, Multiple Inheritance, Ambiguity in Multiple Inheritance, Aggregation, Classes Within Classes.

Polymorphism-concept, relationship among objects in inheritance hierarchy, abstract classes, and polymorphism.

Unit 5: Introduction to Python: **[3 Hrs]**

Object and Data Structure, Comparison Operators, Statements, Loops, Methods and Functions, Control Statement, Modules and Packages, Multithreading, Built in Functions with example, Python Operators, Generators, Python Database Operations, Data Analysis, NumPy, Data Analysis- Pandas with small projects in Python.

Internal Continuous Assessment (ICA):

Students should perform minimum 10 experiments based on the Syllabus

Tentative list :

A. C++ Programs:

1. Problem statement based on Structures.
2. Problem statement based on Arrays.
3. Problem statement based on Strings.
4. Problem statement based on Class.
5. Problem statement based on Function.
6. Problem statement based on Constructors and destructors.
7. Problem statement based on operator overloading.
8. Problem statement based on Multiple Inheritance and polymorphism.

B. Python Programs:

1. Problem statement based on Object and Data Structure.
2. Problem statement based on Methods and Functions.
3. Problem statement based on Loops.
4. Problem statement based on Modules and Packages.
5. Problem statement based on Database Operations.
6. Problem statement based on Multithreading.

Text Books:

1. Object Oriented Programming with C++ -by E. Balagurusamy , Tata McGraw-Hill
2. Programming with C++ -by D. Ravichandran , Tata McGraw-Hill
3. Beginning Python: From Novice to Professional – by Magnus Lie Hetland, Apress
4. Practical Programming: An Introduction to Computer Science Using Python 3 –by Paul Gries, Jennifer Campbell, Jason Montojo, Pragmatic Bookshelf.

Reference Books

1. C++ programming language – by Bjarne Stroustrup, AT& T Labs, Pearson Education.
2. C++ The complete reference - by Herbert Schildt, Ⅱ, Eighth Edition, McGraw Hill Professional.
3. Introducing Python- Modern Computing in Simple Packages –by Bill Lubanovic, O'Reilly Media Publication

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ET221 – Control Systems

Teaching Scheme:
Lecture: 3 hr/week, 3 credits
Tutorial : 1hr/week, 1 credit

Examination Scheme:
ESE : 70 Marks
ISE : 30 Marks
ICA : 25 Marks

Course Objectives:

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

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

1. Analyze various control systems.
2. Calculate transfer function and draw mathematical models for control systems.
3. Obtain transfer function of systems using signal flow graph and block diagram reduction.
4. Analyze control system in time domain.
5. Determine stability of systems.
6. Analyze control system in frequency domain and state space.

SECTION I

Unit 1: Introduction and Mathematical modeling: [07Hrs]

Open loop and Closed loop control systems, examples of control systems: Liquid level control system, missile launching and guidance system, Transfer function of closed loop system, Mathematical modeling of Electrical systems using R, L and C, Transfer function of RLC circuits.

Unit 2: System representation and components: [07Hrs]

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

Unit 3: Time response of systems: **[07Hrs]**

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.

SECTION II

Unit 4: Stability analysis & Root locus: **[08Hrs]**

Concept of stability, absolute and conditional stability, relative stability, Routh – Hurwitz criterion for stability. Concept of root locus, construction of root locus and stability analysis using root locus.

Unit 5: 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 6: State Space Analysis: **[08Hrs]**

State space representation and transfer function, State transition matrix, Decomposition of transfer function, Controllability and observability, Need of compensators, types (Lead, Lag & Lead Lag)

Internal Continuous Assessment (ICA): -

Minimum eight tutorials based on above syllabus (At least one tutorial from each unit).

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.RameshBabu - 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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ET222 – Analog Integrated Circuits

Teaching Scheme:
Lecture: 3 hr/week, 3 credits
Practical : 2 hr/week, 1 credit

Examination Scheme:
ESE : 70 Marks
ISE : 30 Marks
ICA : 25 Marks
POE : 25 Marks

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 nonlinear 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. Develop 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& Differential Amplifier.

Unit 2: Practical opamp & frequency response: [06Hrs]

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: **[07Hrs]**

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.

SECTION-II

Unit 4: Non linear applications: **[07Hrs]**

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

Unit 5: Active filters & Oscillators: **[07Hrs]**

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

Unit 6: Special ICS and its applications: **[07Hrs]**

Voltage regulators- 78xx,79xx, LM317,LM337, IC 555 Timer- basic, astable, monostable.

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. Op-Amp as Clippers and Clampers.
13. V to I convertor with grounded load.
14. Implementation of first and second order low pass Butterworth filer.
15. 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 International Publishers, 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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Credit System structure of S. Y. B. Tech. (Electronics & Telecommunication Engineering) Part-II w.e.f. 2021-2022

ET223 – Principles of Digital Communication

Teaching Scheme:
Lecture: 3 hr/week, 3 credits
Practical : 2 hr/week, 1 credit

Examination Scheme:
ESE : 70 Marks
ISE : 30 Marks
ICA : 25 Marks
POE : 25 Marks

Course Objectives:

1. To make student understand the significance of information theory 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 Error Control Codes.

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

1. Describe & calculate information measures and apply source coding techniques for the memoryless discrete sources.
2. Apply binary block coding techniques for error detection & correction and estimate error detection & correction capabilities of block code.
3. Explicate, demonstrate and analyze different pulse code modulation techniques.
4. Explain, demonstrate and analyze binary and M-ary digital modulation techniques and compare them.
5. Describe mathematical & analytical concepts of matched filter & correlation receivers and explain synchronization techniques.

SECTION - I

Unit 1–Introduction to Information Theory [08hrs]

Introduction to information theory, average and mutual information, Entropy, Joint Entropy and conditional entropy, Rate of information, redundancy, channel capacity, Basic block diagram of digital communication system, comparison of analog & digital system.

Unit 2–Pulse Code Modulation Technique [07hrs]

Quantization – Uniform & Non uniform, Types of digital modulation system- PCM System, Eye Pattern, Intersymbol Interference, Differential PCM, Delta Modulation – Noise in DM, ADM, Line Coding Techniques.

Unit 3–Binary Digital Modulations Techniques [06hrs]

Binary ASK, FSK, PSK, DPSK Coherent and non- coherent Detection. Comparison of digital modulation schemes–Bandwidth, Power requirements, Probability of error, & Equipment complexity.

SECTION – II

Unit 4– M-ary Digital Modulations Techniques [08hrs]

M–ary Signaling scheme, Types of M-ary signaling scheme, constellation diagram and its modulators and demodulators: QPSK signaling scheme, M-ary differential PSK signaling scheme, M-ary wideband FSK signaling scheme, QAM signaling scheme.

Unit 5–Optimum receiver for digital Modulation [07hrs]

Introduction to Optimum receiver, Integrator & dump receiver, Matched filter receiver, Correlation receiver, Synchronization- Symbol Synchronization, Frame synchronization, Carrier recovery circuits.

Unit 6–Error Control Codes [06hrs]

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

Internal Continuous Assessment:

ICA consists of Minimum 8 experiments performed on above syllabus out of which at least 2 experiments must be using MATLAB / Scilab)

Suggestive List of Practicals on

1. PCM
2. DPCM
3. Data Formats
4. DM
5. ADM
6. ASK
7. FSK
8. PSK

9. DPSK
10. QPSK
11. Coding techniques using simulation software (MATLAB/Scilab) Based Experiment.
12. Modulation techniques using simulation software (MATLAB/Scilab) 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 PearsonEducation.
4. Contemporary Communication system using MATLAB by John G. Proakis, M Asonid Salehi, Genhard Bauch

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ET224 – Signals & Systems

Teaching Scheme:
Lecture: 3 hr/week, 3 credits
Tutorial: 1 hr/week, 1 credit

Examination Scheme:
ESE : 70 Marks
ISE : 30 Marks
ICA : 25 Marks

Course Objective:

1. To understand the fundamental characteristics of signals and systems
2. To develop mathematical skills and to solve problems involving convolution and sampling.
3. To represent and to 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 Outcome: At the end of the course, students will be able to-

1. Represent different signals and systems mathematically and 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 plot Amplitude and Phase spectrum
5. Calculate ZT of a function and 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 of System.

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) systems: [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, and 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 eight tutorials based on above syllabus (At least one tutorial from each unit).

- **Text books:**

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

- **Reference Books:**

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

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Credit System structure of S. Y. B. Tech. (Electronics & Telecommunication Engineering) Part-II w.e.f. 2021-2022

ET225 – Data Structures

Teaching Scheme:
Lecture: 3 hr/week, 3 credits
Practical : 2 hr/week, 1 credits

Examination Scheme:
ESE : 70 Marks
ISE : 30 Marks
ICA : 25 Marks

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

1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. Implement given Search problem (Linear Search and Binary Search).
3. Implement given problem of Stacks, Queues and linked list. Also, analyze the same to determine the time and computation complexity.
4. 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. 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, complexity analysis Time-Space trade off. Searching: Linear Search and Binary Search Techniques complexity analysis of searching techniques.

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, Circular Singly Linked Lists: it's all operations and algorithms.

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

Basic Tree Terminologies, Different types of Trees: Binary Tree, Binary Search Tree its operations and complexity analysis, Threaded Binary Tree, AVL Tree, Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity 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, basics of hashing, Different Hashing techniques, and collision resolution techniques.

Internal Continuous Assessment (ICA):

Students should perform minimum twelve practical's based on the following preferably conducted on Unix / Linux platform

Practicals: -

Minimum twelve practicals from the following.

1. Search element from list using linear search and Binary search method.
2. Implementation of stack using array.
3. Implementation of Queue using array.
4. Implementation of circular Queue using array.
5. Implementation of singly Linked list.
6. Implementation of stack using Linked list.
7. Implementation of Queue using Linked list.

8. Implementation of Doubly Linked list.
9. Implementation of Josephus problem using Circular Linked list.
10. Find Factorial of a given no, by defining recursive function.
11. Fibonacci sequence implementation using recursive function.
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:

a. Fundamentals of Data Structures, Ellis Horowitz, Sartaj Sahni (Galgotia Book Source).
b. Data Structures and Program design, Robert L. Kruse (PHI).
c. Data structure and algorithm, mark Allen Weiss (Pearson Publication, Second edition).
d. Data Structures using C and C++, Rajesh K. Shukla, Wiley Precise.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

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ET226 – Electronic Software Lab-II

Teaching Scheme:
Lecture: 1 hr/week, 1 credit
Practical : 4 hr/week, 2 credits

Examination Scheme:
ICA : 25 Marks
POE: 50 Marks

Course Objectives:

1. Introduce procedural and object-oriented style for writing Python scripts.
2. Introduce standard library packages and modules in Python.
3. To teach testing, debugging and profiling of Python scripts.

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

1. Write Python scripts using procedure and object oriented approach of writing a computer program.
2. Exhibit ability to use Python's standard library packages to provide solution to a given problem.
3. Test and debug python script for a given problem.

Course Prerequisite:

- Basic knowledge of programming concepts like Variables, Loops, Control Statements, etc in any programming language like and basic C, C++ and python.

Section – I

Unit 1: Introduction to basics of Python [04Hrs]

Python Interpreter, Program Execution, Data types and variables, Collection data types, Control structures, loops and functions, Lambdas, Generators, Exception Handling, String handling, Scope of variables, Modules, Packages, Command line arguments. Built-in: Functions, Constants, Types, Exceptions.

Unit 2: Object Oriented Programming in Python [06Hrs]

OOPS Concepts, Classes and objects , Classes in Python, Constructors, Data hiding, Creating Classes, Instance Methods, Special Methods, Class Variables, Inheritance, Polymorphism, Type Identification, Custom Exception Classes, Iterators, generators and decorators.

Unit 3: File handling in Python [04Hrs]

I/O and Error Handling In Python :Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data From a File, Additional File Methods, Handling

IO Exceptions, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions, Working with Directories.

Section – II

Unit 4: Relational databases [04Hrs]

SQL statements for data manipulation, Using SQLite Manager to work with a database, Using Python to work with a database, Creating a GUI that handles an event, working with components.

Unit 5: Implement Machine Learning algorithms [06Hrs]

Usage of Numpy for numerical Data,Usage of Pandas for Data Analysis, Matplotlib for Python plotting, Seaborn for Statical plots, interactive Dynamic visualizations, SciKit for Machine learning.

Unit 6: Implementation of algorithms and application of python programming: [04Hrs]

Reading and writing CSV files, Calculation of simple and compound interest. Area and volume estimation of polygons, analysis of data from CSV files, plotting performance graphs from data set.

Internal Continuous Assessment (ICA):

1. Students should undertake minimum of 12 practical/assignments based on each of above topic.
2. The assignments should test and develop student's practical proficiency and ability to use Python standard library modules and packages efficiently in writing effective code for varied applications scenarios & requirements, use cases.
3. Use of IDEs like PyCharm, Eclipse with PyDev, Jupyter Notebook for Interactive development and debugging of Python applications is highly recommend enhancing hands on skills in Python Programming of Students.
4. Every assignment shall be performed under Python 2.x or 3.x runtime environment configured using any of the following tools 1) pyenv 2) virtualenv 3) Anaconda

- **Text Book:**

1. e-Resource : Python 2.7.16 documentationhttps://docs.python.org/2/
2. e-Resource : Python 3.7.3 documentationhttps://docs.python.org/3/
3. Programming in Python 3, Second Edition, Mark Summer field

- **Reference Books:**

1. Python Cookbook, Third Edition, David Beazley and Brian K. Jones, Shroff Publishers & Distributors Pvt. Ltd., ISBN :978-93-5110-140-6
2. Learning Python FIFTH EDITION Mark Lutz
3. Programming Python (English) 4Th Edition Mark Lutz
4. Testing Python, David Sale, Wiley India (P) Ltd., ISBN :978-81-265-5277-1