Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Department of Electronics and Telecommunication Engineering

S.Y. B. Tech Syllabus 2024-25 (As per NEP 2020)

About E&TC Department

- Involvement of Experts from IITs, Govt. Colleges, Reputed Industries, Alumni and Students in development of curriculum.
- Automatic Bank Credit System (ABC)
- Choice of Electives
- Remedial Teaching
- Sponsorship for Publications and IPR
- Research Mentorship
- Industry Internship
- Provision of Credit Transfer Scheme (CTS)
- Peer Teaching Scheme
- Teacher Guardian Scheme (TGS)
- Proficiency Courses
- MOUs with Industries

INSTITUTE VISION AND MISSION

VISION

To achieve Academic Excellence through Persistent and Synergic Collaborations amongst all Stakeholders.

MISSION

1. To ensure holistic development of students as lifelong learners and problem solvers through value-based quality education.
2. To motivate faculty to attain the state-of-the-art knowledge and wisdom in their domain and be a facilitator towards co creation of knowledge.
3. To frame and deploy conducive and empowering policies for multifaceted growth of students, faculty and staff to make them contributors towards excellence.
4. To partner with industry for mutually beneficial relations to generate employable and deployable workforce.
5. To fulfill the aspirations of alumni, parents, society, region and nation at large by generating technically competent and contributing manpower.

DEPARTMENT VISION AND MISSION

VISION

To develop professionals in Electronics and Telecommunication Engineering to contribute in solving technological problems faced by society.

MISSION

1. To impart value added education for developing professional competencies and life skills.
2. To empower facilitators with knowledge, skills and conducive work culture.
3. To reciprocate with collaborating organizations and industries to ensure continual improvements.
4. To integrate efforts of all stake holders for the benefit of society.

Programme Educational Objectives (PEOs)

A graduate in E&TC will be able to demonstrate:

PEO1: To apply the knowledge of Electronics and Telecommunication Engineering to build career in core and allied industries.

PEO2: To prepare students for higher studies, competitive exams and multidisciplinary work.

PEO3: To follow professional ethics and address social concerns.

PEO4: To be lifelong learner to engross newer technologies.

Program Specific Outcomes (PSOs)

At the end of the programme students will be able to demonstrate:

PSO1: To develop competencies to solve real-life problems in the Electronics and Telecommunication Engineering domain at the same time inculcate professional behavior imbibe with human values and ethics.

PSO2: To acquire the knowledge of embedded systems, communication, signal processing for hardware/software design and development.

PSO3: To demonstrate the competencies to use modern tools and techniques to design electronic systems in diverse fields as per societal needs.

Program Outcomes (POs)

Engineering Graduates 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 modelling 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 the 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.

Second Year (SY B. Tech.) Electronics and Telecommunication Engineering w. e. f. AY:2024-2025

SEMESTER-I

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
		TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
BS23202	Advanced Mathematics for E&TC Engineering	3	-	1	-	20	70	20	-	-	110	3	-	1	4
ET23201	Analog Circuits	3	2	-	20	20	70	20	20	-	150	3	1	-	4
ET23202	Digital Logic Design	3	2	-	20	20	70	20	20	-	150	3	1	-	4
ET23203	Signals and Systems	3	2	-	20	20	70	20	-	20	150	3	1	-	4
ET23204	Network Theory	3	-	-	20	20	70	-	-	-	110	3	-	-	3
ET23051	Multidisciplinary Minor Course	2	2	-	20	20	50	20	-	-	110	2	1	-	3
Total		17	8	01	100	120	400	100	40	20	780	16	05	01	22

SEMESTER-II

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
		TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
ET23211	Control Systems	3	-	1	20	20	70	20	-	20	150	3	-	1	4
ET23212	Analog and Digital Communication	3	2	-	20	20	70	20	20	-	150	3	1	-	4
ET23213	Microcontrollers	3	2	-	20	20	70	20	20	-	150	3	1	-	4
ET23214	Electromagnetic Waves	3	-	-	20	20	70	-	-	-	110	3	-	-	3
ET23051	Multidisciplinary Minor Course	2	2	-	20	20	50	20	-	-	110	2	1	-	3
OE230XX	Open Elective	2	-	-	-	-	50	-	-	-	50	2	-	-	2
ET23215	VSC- Programming in Python	-	4	-	-	-	-	40	20	-	60	-	2	-	2
Total		16	10	1	100	100	380	120	60	20	780	16	05	01	22

SD Biradar Autonomy Coord.	Dr. BH Patil HoD – E&TC	Dr. SM Bhosle Dean Academics	Dr. RS Bichkar Principal

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Bucket of Multidisciplinary Minor Courses

Multidisciplinary Minor Subjects	
Subject Code	**Subject Name**
AI23051	AI & Machine Learning
AI23052	Data Science
AI23053	Generative AI (Sem V+)
CO23051	Cloud Computing
CO23052	High Performance Computing (Sem V+)
CO23053	Computer Graphics & Gaming
IT23051	Cyber security
IT23052	Full Stack Development
ET23051	Embedded Systems
ET23052	Drone Technology
ET23053	Internet of Things
CE23051	Waste Management
CE23052	Green building & smart cities
ME23051	3-D Printing
ME23052	Robotics & Automation
EL23051	Solar Technology
EL23052	Industrial Automation
GS23051	Nanotechnology
GS23052	Linear Algebra and Statistics

Bucket of Open Electives

Open Elective Subjects	
Subject Code	**Subject Name**
OE23001	Digital Marketing
OE23002	Professional Leadership
OE23003	Organizational Behaviour
OE23004	Industrial Management
OE23005	Disaster Management
OE23006	Energy Economics & Management
OE23007	Operations Research
OE23008	Intellectual Property Rights
OE23009	Cyber Laws
OE23010	Bioinformatics
OE23011	Biotechnology
OE23012	International Relations
OE23013	Universal Human Values
OE23014	Education Technology
OE23015	Design Thinking
OE23016	Accounting & Finance
OE23017	Sustainability & Climate Change
OE23018	Agriculture Technology
OE23019	Architectural Technology

HONORS DEGREE (only for students having CGPA >= 7.5)
Honor: Computational Intelligence
Honor: Cloud Computing and Virtualization, Data Science
Honor: Data Science
Honor: Artificial Intelligence
Honor: Cyber security
Honor: VLSI Design Technology
Honor: Advanced Communication Systems
Honor: Advances in Construction Technology
Honor: Advanced Structural Engg.
Honor: Robotics and Automation
Honor: Refrigeration & Air-conditioning
Honor: Renewable Energy and E- mobility

DOUBLE MINOR DEGREE (only for students having CGPA >= 7.5)
Double Minor: Artificial Intelligence and Data Science
Double Minor: Cloud Computing and Virtualization
Double Minor: Full Stack Development
Double Minor: Embedded Systems and Real-Time OS
Double Minor: Municipal or Urban Engineering
Double Minor: Enterprise Resource Planning
Double Minor: Digital Mfg. and Robotics
Double Minor: Renewable Energy

Second Year (SY B. Tech.) Electronics and Telecommunication Engineering

w. e. f. AY:2024-2025

SEMESTER-I

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
		TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
BS23202	Advanced Mathematics for E&TC Engineering	3	-	1	-	20	70	20	-	-	**110**	3	-	1	4
ET23201	Analog Circuits	3	2	-	20	20	70	20	20	-	**150**	3	1	-	4
ET23202	Digital Logic Design	3	2	-	20	20	70	20	20	-	**150**	3	1	-	4
ET23203	Signals and Systems	3	2	-	20	20	70	20	-	20	**150**	3	1	-	4
ET23204	Network Theory	3	-	-	20	20	70	-	-	-	**110**	3	-	-	3
ET23051	Multidisciplinary Minor Course	2	2	-	20	20	50	20	-	-	**110**	2	1	-	3
Total		**17**	**8**	**01**	**100**	**120**	**400**	**100**	**40**	**20**	**780**	**16**	**05**	**01**	**22**

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BS23202: Advanced Mathematics for E&TC Engineering

Teaching Scheme:	Credits: 04	Examination Scheme:
Theory: 03 Hours/Week		In Sem: 20 Marks
Tutorial: 01 Hours/Week		End Sem:70 Marks
		Termwork:20 Marks

Prior knowledge of

Differential & Integral Calculus, Taylor series, Differential equations of first order and first degree, Fourier series, Vector algebra.

Course Objectives:

1. To familiarize the students with concepts and techniques in Ordinary differential equations, Fourier Transform & Z-Transform, Numerical methods, and Vector Calculus.
2. The aim is to equip them with the techniques to understand advanced-level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.

Course Outcomes: On completion of the course, the learner will be able to -

CO1: Solve higher-order linear differential equations using appropriate techniques for modeling and analyzing electrical circuits.

CO2: Understand the concepts of Fourier transform, and Z-transform and apply them to difference equations.

CO3: Learn various numerical methods and apply them to solve problems of interpolation, integration, and ODE.

CO4: Understand the concepts of vector differentiation and integration, and apply them in their field.

CO5: Develop and understand the basics of probability theory, and distribution functions.

CO6: Understand stochastic processes and apply them for characterization.

Course Contents

Unit I: Linear Differential Equations (LDE) and Applications (07 Hrs.)

LDE of n^{th} order with constant coefficients, Complementary Function, Particular Integral, General method, shortcut methods, Method of variation of parameters, Cauchy's and Legendre's DE, Modeling of Electrical circuits.

Unit II: Transforms (07 Hrs.)

Fourier Transform (FT): Fourier transform, Fourier Sine & Cosine transforms and their inverses.

Z-Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations.

Unit III: Numerical Methods (07 Hrs.)

Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formula.

Integration: Trapezoidal and Simpson's rules.

Solution of ODE: Eulers, Euler's modified, and Runge-Kutta 4^{th} order methods.

Unit IV: Vector Calculus (07 Hrs.)

Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, and Scalar potential. Line, Surface, and Volume integrals, Work-done, Green's Lemma. Applications to problems in Electromagnetic fields.

Unit V: Probability Theory (07 Hrs.)

Discrete random variables, probability mass function, probability distribution function. Continuous random variables, probability density function, probability distribution function.

Joint distributions, functions of one and two random variables. Conditional distribution, densities, and moments; Characteristic functions of a random variable.

Unit VI: Stochastic Process (07 Hrs.)

Markov, Chebyshev, and Chernoff bounds.

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square), Limit theorems, Strong and weak laws of large numbers, and central limit theorem.

Random process, Stationary processes, Mean and covariance functions.

Tutorials:

1. Solve Linear Differential Equations by General, shortcut, Variation of Parameter, Cauchy's and Legendre's method
2. Solve problems in the Modeling of Electrical circuits.
3. Find Fourier transform, Fourier sine, and cosine transforms of different functions.
4. Solve difference equations by using Z transformations.
5. Find polynomials by using Newton's and Lagrange's Interpolation formulas.
6. Solve ordinary differential equations by using Eulers, Euler's modified, and Runge-Kutta's 4th-order methods. Solve integrations by using Trapezoidal and Simpson's rules.
7. Check whether the given vector fields are irrotational or not.
8. Solve problems of Line, Surface, and Volume integrals, Work-done, and Green's Lemma.
9. Examples of discrete random variables.
10. Examples of continuous random variables.
11. Problems based on stochastic processes.

Textbooks:

1. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill).
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).
3. Probability and Random Processes with Applications to Signal Processing by H. Stark and J. Woods (3rd Edition, Pearson Education).

Reference Books:

1. Advanced Engineering Mathematics, 10e, by Erwin Kreyszig (Wiley India).
2. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
3. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Cengage Learning).
4. Differential Equations, 3e by S. L. Ross (Wiley India).
5. Numerical Methods for Engineers, 7e by S. C. Chapra and R. P. Canale (McGraw-Hill Education.
6. Probability, Random Variables, and Stochastic Processes, Fourth Edition, A. Papoulis and S. Unnikrishnan Pillai, McGraw Hill.
7. Introduction to Probability Theory with Stochastic Processes, K. L. Chung, Springer International.
8. Introduction to Probability, P. G. Hoel, S. C. Port, and C. J. Stone, UBS Publishers.
9. Introduction to Stochastic Models, Harcourt Asia, S. Ross, Academic Press.

SD Biradar Autonomy Coord.	Dr. BH Patil HoD – E&TC	Dr. SM Bhosle Dean Academics	Dr. RS Bichkar Principal

VPKBIET BARAMATI Affiliated to S.P.P.U. Pune Id No. PU/PN/Engg./152/2000 PUNE (MS.)

ET23201:- Analog Circuits

Teaching Scheme	Credits	Examination Scheme
Teaching Scheme: Theory: 03 Hours/Week Practical: 02 Hours/Week	Credits 04	Examination Scheme: Activity:20 Marks In Sem: 20 Marks End Sem:70 Marks Practical: 20 Marks Term work: 20 Marks

Prior knowledge of

- Basic electronics components such as transistor, op-amp and concept of basic circuit laws like KVL and KCL

is essential.

Course Objectives:

This course emphasizes on effective knowledge of semiconductor devices -FET, BJT MOSFET and Op-Amp in the field of Electronics and telecommunication Engineering. It also gives insights on applications such as amplifiers, A-D and D-A converter and op-amp based circuits.

Course Outcomes:

After completion of this course, students will be able to,

CO1: Design various circuits utilizing semiconductor devices.

CO2: Implement circuit and test the performance using FET and MOSFET.

CO3: Explain small signal model of BJT and FET.

CO4: Classify the power amplifier circuits.

CO5: Demonstrate the linear and non-linear applications of Op-Amp.

CO6: Compare A-D and D-A conversion techniques.

Course Contents

Unit I: Applications of Semiconductor Devices (06 Hrs.)

Diode wave shaping circuits- Clippers and Clampers, Voltage multipliers. Transistor as a switch, Transistorized relay driver circuit.

DC Regulated power supply, and its performance parameters, Types: series regulator, shunt regulator, Protection circuits: Over voltage protection, over current protection.

Unit II: Amplifiers (07 Hrs.)

BJT small signal model – Analysis of CE amplifier, comparison of CE, CB and CC, FET small signal model– Analysis of CS amplifiers. Concept of frequency response.

Feedback Amplifiers: - Feedback Concept, Introduction to multistage amplifier, Classification of amplifiers based on feedback topology, (Voltage, Current, Trans-conductance and Trans-resistance amplifiers), Effect of negative feedback on various performance parameters of an amplifier, Analysis of voltage series feedback topology, Comparison of feedback topologies.

Unit III: Power Amplifier (06 Hrs.)

Classes of power amplifiers – Class A, Class B, Class AB, Class C and Class D amplifiers, Analysis of Class A, Class B, Class AB amplifiers, Distortions in amplifiers, concept of Total Harmonic Distortion (THD), Comparison of power amplifiers.

Unit IV: Op-Amp and its applications (07 Hrs.)

Introduction of Op-amp, Differential amplifier using op-amp, Instrumentation amplifier, V to I & I to V Converter, Precision Rectifiers, Study of comparator, Schmitt Trigger, Peak Detectors, Sample and hold circuit.

Unit V: Oscillators and Signal Generators (07 Hrs.)

Oscillator introduction, Condition for oscillations, phase shift – Wien Bridge, Hartley, Colpitts and Crystal oscillators using BJT/Op-amp.

Signal Generators: Sine wave generators, Triangular wave generators, Saw tooth generators, V to F and F to V converters, PWM generator.

Unit VI: ADC and DAC (06 Hrs.)

Introduction of ADC and DAC, Need of ADC and DAC, Types of ADC, characteristics, specifications, Advantages and Disadvantages of ADC's, Detailed study of IC 0808/0809. Types of DAC, characteristics, specifications, advantages and disadvantages of each type of DAC, IC based DAC.

Text Books:

T1.MillmanHalkias, "Integrated Electronics-Analog and Digital Circuits and Systems", Tata McGraw Hill, 2000.

T2. Donald Neaman, "Electronic Circuit Analysis and Design", 3rd Edition, Tata McGraw Hill.

T3. Ramakant A. Gaikwad, "Op Amps and Linear Integrated Circuits", Pearson Education second and latest edition.

T4. S. Salivahanan &Bhaaskaran, "Linear Integrated Circuits", 1st Edition, Tata McGraw Hill.

Reference Books:

R1. David A. Bell, "Electronic Devices and Circuits", 5th Edition, Oxford press.

R2. R. L. Boylstad, L. Nashlesky, "Electronic Devices and circuits Theory", 9th Edition, Prentice Hall of India, 2006.

R3. D. Roy Choudhary, Shail Jain "Linear Integrated Circuits", New Age International.

R4. Soclof, "Design and Applications of Analog Integrated Circuits", PHI.

List of Experiments

Part-A: Perform any 5 experiments

1. Implement single stage FET Amplifier in CS configuration and verify DC operating point.
2. Build and test single stage CS amplifier using FET. Calculate Ri, Ro and Av.
3. Simulate frequency response of single stage CS amplifier (use same circuit) and find the

bandwidth 4. Implement power amplifier and verify the performance parameters. 5. Simulate Voltage-Series feedback amplifier and calculate Rif, Rof, Avf and Bandwidth. 6. Simulate LC oscillator using FET. 7. Implement Wein-bridge /RC phase shift oscillator using FET/MOSFET. 8. Simulate MOSFET/ CMOS Inverter. 9. Build and test MOSFET as a switch.
Part-B: Perform any 5 experiments
1. Measure op-amp parameters and compare with the specifications. (a) Measure input bias current, input offset current and input offset voltage. (b) Measure slew rate. (c) Measure CMRR. (d) Compare the result with datasheet of corresponding Op Amp. 2. Design of Summing, scaling, and averaging amplifier for given specification. 3. Verify V to I convertor. 4. Build and test differentiator and integrator. 5. Build and test precision half & full wave rectifier. 6. Build and test Comparator and Schmitt trigger. 7. Implement DAC and verify the parameters. 8. Implement ADC and verify the parameters. 9. Build and test square & triangular wave generator.

SD Biradar	Dr. BH Patil	Dr. SM Bhosle	Dr. RS Bichkar
Autonomy Coord.	HoD – E&TC	Dean Academics	Principal

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ET23202:- Digital Logic Design		
Teaching Scheme: Theory: 03 Hours/Week Practical: 02 Hours/Week	Credits 04	Examination Scheme: Activity:20 Marks In Sem: 20 Marks End Sem:70 Marks Practical: 20 Marks Term work: 20 Marks

Prior knowledge of

- Logic gates and Boolean algebra

is essential.

Course Objectives:

The course is served to acquaint the students with the fundamental principles of digital logic and various digital devices used to implement logical operations on variables. The course contents lay the foundation for further studies in VLSI design. HDL and related design approach will get explore to students. The last unit is to explore PLD architectures with advanced features.

Course Outcomes:

After completion of this course, students will be able to,

CO1: Understand basic combinational logic circuits.

CO2: Build modular combinational circuits with MUX/DEMUX, Decoder, and Comparator etc.

CO3: Construct sequential logic circuits

CO4: Understand the concept of state machines, PLA, PAL or PLD

CO5: Apply knowledge of the digital logic family for the selection of IC's used in applications.

CO6: Design and simulate arithmetic and sequential circuits using HDL tool flow.

Course Contents

Unit I: Combinational Logic Design-I (06 Hrs.)

Definition of combinational logic, canonical forms, Standard representations for logic functions, k-map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (up to 4 variables), don't care conditions, Design Examples: Arithmetic Circuits, BCD - to – 7 segment decoder, Code converters. Adders and their use as subtractor, 4-bit Binary Adder, 4-bit BCD adder, look ahead carry, ALU.

Unit II: Combinational Logic Design-II (06 Hrs.)

Digital Comparator, Parity generators/checkers, Multiplexers and their use in combinational logic designs, multiplexer trees, De-multiplexers and their use in combinational logic designs, Decoders, Demultiplexer trees.

Unit III: Sequential Logic Design (06 Hrs.)

1-Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation Table for flip flops, Timing parameters of flip flops. Application of Flip flops: Registers, Shift registers, Counters (ring counters, twisted ring counters), ripple counters, up/down counters, synchronous counters.

Unit IV: State Machines & Programmable Logic Devices (06 Hrs.)

Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation, Sequence detector. Introduction to Algorithmic state machines- construction of ASM chart and realization for sequential circuits.

Unit V: Digital Logic Families (06 Hrs.)

Classification of logic families, Characteristics of digital ICs, Operation of TTL NAND gate, active pull up, wired-AND, open collector output, unconnected inputs. Tri-State logic. CMOS logic – CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic, open drain output. Interfacing CMOS and TTL. Comparison table of Characteristics of TTL, CMOS, ECL, RTL, I2L, DCTL.

Unit VI: Programmable Logic Devices (07 Hrs.)

Programmable logic devices: Detail architecture, Study of PROM, PAL, PLA. Designing combinational circuits using PLDs. Semiconductor memories: memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM ROM, EPROM, EEPROM, SRAM, and DRAM.

Text Books:

1. R.P. Jain, “Modern digital electronics”, 3rd edition, 12^{th} reprint Tata McGraw Hill Publication.
2. M. Morris Mano, “Digital Logic and Computer Design”, 4^{th} edition, Prentice Hall of India.
3. D. L. Perry, "VHDL Programming by Example" 4^{th} Edition, McGraw Hill Publication.

Reference Books:

1. C.H. Roth, “Digital System Design using VHDL”, 3^{rd} Edition, CENGAGE Learning.
2. J. F. Wakerly, “Digital Design: Principles and Practices”, 3^{rd} Edition, Pearson Education.
3. A. Anand Kumar, “Fundamentals of digital circuits”, 4^{th} Edition, Prentice Hall of India Learning.
4. D.P. Leach, A. P. Malvino and G. Saha, “Digital Principles and Application”, 7^{th} Edition, Tata McGraw Hill Publication.

List of Experiments
1. Study of IC-74LS153 as a Multiplexer: a. Design and Implement 8:1 MUX using IC-74LS153 & Verify its Truth-Table. b. Design & Implement the given 4 variable functions using IC74LS153. Verify its Truth-Table. 2. Design and Implement full adder / subtractor function using IC-74LS138. 3. Design & Implement 3-bit code converter using IC-74LS138. (Gray to Binary/Binary to Gray). 4. Design and Implement 1 digit BCD adder using IC-74LS83. 5. Design and Implement 5-bit comparator. 6. Design and Implement MOD-N / MOD-NN using IC-74LS90 and draw a Timing diagram. 7. Design & Implement MOD-N Up/down Counter using IC74HC191/ IC74HC193. Draw Timing Diagram. 8. Design and Simulate 4-bit right shift and left shift register using D-flip flop. 9. Design and Simulate a Pulse train generator using IC-74HC194/IC74LS95. 10. Design and Simulate 4-bit Ring Counter/ Twisted ring Counter using shift registers IC 74HC194/ IC74LS95.

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ET23203:- Signals and Systems

Teaching Scheme:	Credits	Examination Scheme:
Theory: 03 Hours/Week Tutorial: 01 Hours/Week	04	Activity:20 Marks In Sem: 20 Marks End Sem:70 Marks Term work: 20 Marks

Prior knowledge of

- Basics of semiconductor Physics
- Basic Electronics Engineering

is essential.

Course Objectives:

- To understand the mathematical representation of continuous and discrete time signals and systems.
- To classify signals and systems into different categories.
- To analyze Linear Time Invariant (LTI) systems in time and transform domains.
- To build basics for understanding of courses such as signal processing, control system and communication.
- To develop the basis of probability and random variables.

Course Outcomes: On completion of the course, learner will be able to -

CO1: Identify, classify basic signals and perform operations on signals.

CO2: Identify, Classify the systems based on their properties in terms of input output relation and in terms of impulse response and will be able to determine the convolution between two signals.

CO3: Analyze and resolve the signals in frequency domain using Fourier series and Fourier Transform.

CO4: Resolve the signals in the complex frequency domain using Laplace Transform, and will be able to apply and analyze the LTI systems using Laplace Transforms.

CO5: Define and Describe the probability, random variables and random signals. Compute the probability of a given event, model, compute the CDF and PDF.

CO6: Compute the mean, mean square, variance and standard deviation for given random variables using PDF.

Course Contents

Unit I: Introduction to Signals and Systems (06 Hrs.)

Classification of signals: Continuous time and discrete time, even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power. Operations on signals, Elementary signals: ramp, rectangular, triangular, signum, sinc exponential, sine, step, impulse and its properties.

Systems: Definition, Classification: linear and nonlinear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.

Unit II: Continuous time and discrete time Linear shift invariant (LSI) systems (06 Hrs.)

System modeling: Input output relation, impulse response, block diagram, integro-differential equation. Definition of impulse response, convolution integral, convolution sum, computation of convolution integral using graphical method for unit step to unit step, unit step to exponential, exponential to exponential and unit step to rectangular, rectangular to rectangular only. Computation of convolution sum. Properties of convolution, system interconnection, system properties in terms of impulse response, step response in terms of impulse response.

Unit III: Fourier series (06 Hrs.)

Fourier series: Fourier series (FS) representation of periodic Continuous Time (CT) signals, Dirichlet condition for existence of Fourier series, Amplitude and phase response, FS representation of CT signals using trigonometric and exponential Fourier series, Gibbs phenomenon.

Unit IV: Fourier Transform (06 Hrs.)

Definition CT and DT Fourier transforms. CT Fourier transform and its properties, problem solving, amplitude spectrum, phase spectrum of the signal and system. DT Fourier transform, problem solving using DTFT, Interplay between time and frequency domain using sinc and rectangular signals.

Analogy between CTFS, DTFS and CTFT, DTFT. Limitations of FT and need of LT and ZT.

Unit V: Laplace Transform (06 Hrs.)

Definition of Laplace Transform (LT), Limitations of Fourier transform and need of Laplace transform, ROC, Properties of ROC, Laplace transform of standard periodic and aperiodic functions, properties of Laplace transform and their significance, Laplace transform evaluation using properties, Inverse Laplace transform, stability considerations in S domain, Application of Laplace transforms to the LTI system analysis.

Unit VI: Analysis of DT Systems using Z transform (06 Hrs.)

Definition of unilateral and bilateral Z transform, Properties of Z transform, Inverse Z transform, Analysis of LTI DT System, Stability and Causality considerations of LTI system.

Text Books:

1. Simon Haykins and Barry Van Veen, "Signals and Systems", Wiley India, 2nd Edition.
2. M.J. Roberts "Signal and Systems", Tata McGraw Hill.
3. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, PHI, 4th Edition.

Reference Books:

1. Charles Phillips, "Signals, Systems and Transforms", Pearson Education, 3rd Edition.
2. Peyton Peebles, "Probability, Random Variable, Random Processes", Tata Mc Graw Hill, 4th Edition.
3. A. Nagoor Kanni, "Signals and Systems", McGraw Hill, 2nd Edition.

MOOC / NPTEL Courses:

1. NPTEL Course "Principles of Signals & System" https://nptel.ac.in/courses/108/104/108104100/
2. Lecture Series on, "Signals & Systems" http://www.nptelvideos.in/2012/12/signals-and-system.html

Signals & Systems Tutorial

1. A) Sketch and write mathematical expression for the following signals in Continuous Time (CT) and Discrete Time (DT)

a) Sine b) Rectangular c) Triangular d) Exponential
e) Unit Impulse f) Unit Step g) Ramp h) Signum
i) Sinc h) Gaussian

B) Classify and find the respective value for the above signals if applicable

a) Periodic / Non Periodic b) Energy / Power /Neither c) Even and Odd signal

2. State and prove the various properties of CT Fourier Transform. Take rectangular and sinc signals as examples and demonstrate the applications of CTFT properties. Demonstrate the interplay between the time and frequency domain.

3. State and prove the properties of CT Laplace Transform. Take any example of a system in the time domain and demonstrate the application of LT in system analysis.

4. Take any two CT and DT signals and perform the following operations: Amplitude scaling, Addition, multiplication, differentiation, integration (accumulator for DT) Time scaling, Time folding, and Time

shifting.

5. Express any two system mathematical expressions in input output relation form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time invariant, Invertible.

6. Express any two system mathematical expressions in impulse response form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time invariant, Invertible.

7. Perform Convolution Integral of two Continuous time signals and Convolution Sum of any two Discrete Time signals. (Various Combinations can be taken for this.)

8. List and Explain the properties of CDF & PDF.

9. Write a MATLAB program to Calculate and plot Fourier Transform and Z-Transform of a given signal.

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Autonomy Coord.	HoD – E&TC	Dean Academics	Principal

ET23204:- Network Theory

Teaching Scheme:	Credits	Examination Scheme:
Theory: 03 Hours/Week	03	Activity:20 Marks In Sem: 20 Marks End Sem:70 Marks

Prior knowledge of

1. Basics of electrical & electronics engineering
2. Fundamentals of mathematics

is essential.

Course Objectives:

1. To introduce the fundamentals of network simplification techniques and network theorems for linear circuits.
2. To deliver the concepts related to fundamentals of network graph theory for resistive networks.
3. To introduce the transient analysis of linear circuits like series RL, RC and RLC circuits using time as well as frequency domain analysis.
4. To make students familiarize about the two port network parameters and network functions.

Course Outcomes:

After completion of this course, students will be able to,

1. Analyze the DC & AC linear circuits for current, voltage or power using basic circuit simplification techniques
2. Analyze the DC & AC linear circuits for current, voltage or power using network theorems.
3. Solve the given resistive network using graph theory for current, voltage or power.
4. Analyze the responses of series RL, RC, RLC circuits using time domain method.
5. Determine the network parameters of two port networks and driving point, transfer functions for one port & two port networks.
6. Analyze parameters of Transmission lines for Lossless/Low Loss Characterization.

Course Contents

Unit I: Basic Circuit Analysis and Simplification Techniques (06 Hrs.)

Introduction: Basic Laws, Independent and dependent sources and their interconnection and power calculations.

Network analysis: Mesh, Super mesh, Node and Super node analysis, Source transformation and source shifting.

Unit II: Network Theorems (05 Hrs.)

Superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, reciprocity theorem and Miller's Theorem.

Unit III: Graph Theory for Linear Networks (06 Hrs.)

Network graph, tree, co-tree, and loops. Incidence matrix, tie-set, cut-set matrix. Formulation of equilibrium equations in matrix form, solution of resistive networks.

Unit IV: Transient analysis of linear circuits using time domain method (06 Hrs.)

Initial conditions, Analysis of source free and source driven series RL & RC circuits for DC voltage source. Introduction to source free and source driven series RLC circuits for DC voltage source. Over damped, Under damped and critical damped series RLC circuit.

Unit V: Two Port Network Parameters and Network Functions (06 Hrs.)

Terminal characteristics of network: Z, Y, h, ABCD Parameters; Reciprocity and Symmetry conditions, Applications of the parameters.

Network functions for the one port and two port networks: Driving point and transfer functions, Poles and Zeros of Network functions, necessary conditions for stability and reliability of point & transfer functions, Time domain behaviour from Pole-Zero plot and Stability of network.

Unit VI: Transmission Lines (07 Hrs.)

Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristics Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless/Low Loss Characterization, Distortion – Condition for Distortion less and Minimum Attenuation, Illustrative Problems. SC and OC Lines, Input Impedance Relations, Reflection Coefficient, VSWR, λ/4, λ 2, λ /8 Lines – Impedance Transformations, Significance of Zmin and Zmax, Smith Chart – Configuration and Applications, Single Stub Matching, Illustrative Problems.

Text Books:

1. "Electrical Circuits" – A. Chakrabarhty, Dhanipat Rai & Sons.
2. "Network Analysis" – N.C Jagan and C. Lakhminarayana, BS publications.
3. "A Text book of Electrical Technology" by B.L Theraja and A.K Theraja, S.Chand publications
4. "Basic Concepts of Electrical Engineering" – PS Subramanyam, BS Publications.
5. "Transmission Lines and Networks" – Umesh Sinha, Satya prakashan, (Tech. India Publications), New Delhi.

Reference Books:

1. Engineering Circuits Analysis – William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition.
2. Basic Electrical Engineering – S.N. Singh PUI.
3. Electrical Circuits – David A. Bell, Oxford Printing Press.
4. Principles of Electrical Engineering by V.K Mehta, Rohit Mehta, S. Chand publications.
5. Electrical Circuit Analysis – K.S. Suresh Kumar, Pearson Education.

NPTEL Links:

1. https://nptel.ac.in/courses/108/105/108105159/

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VPKBIET BARAMATI
Affiliated to S.P.P.U. Pune
Id No. PU/PN/Engg./152/2000
PUNE (MS.)

Second Year (SY B. Tech.) Electronics and Telecommunication Engineering

w. e. f. AY:2024-2025

SEMESTER-II

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
		TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
ET23211	Control Systems	3	-	1	20	20	70	20	-	20	**150**	3	-	1	4
ET23212	Analog and Digital Communication	3	2	-	20	20	70	20	20	-	**150**	3	1	-	4
ET23213	Microcontrollers	3	2	-	20	20	70	20	20	-	**150**	3	1	-	4
ET23214	Electromagnetic Waves	3	-	-	20	20	70	-	-	-	**110**	3	-	-	3
ET23051	Multidisciplinary Minor Course	2	2	-	20	20	50	20	-	-	**110**	2	1	-	3
OE23001	Open Elective	2	-	-	-	-	50	-	-	-	**50**	2	-	-	2
ET23215	VSC- Programming in Python	-	4	-	-	-	-	40	20	-	**60**	-	2	-	2
Total		16	10	01	100	100	380	120	60	20	780	16	05	01	22

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ET23211:- Control Systems

Teaching Scheme:	Credits	Examination Scheme:
Theory: 03 Hours/Week Practical: 02 Hours/Week	04	Activity:20 Marks In Sem: 20 Marks End Sem:70 Marks Oral: 20 Marks Term work: 20 Marks

Prior knowledge of

- Basic Electrical Engineering
- Basic Electronics Engineering

is essential

Course Objectives:

- To Introduce elements of control system and their modeling using various Techniques.
- To get acquainted with the methods for analyzing the time response and Stability of System
- To Introduce and analyze the frequency response and Stability of System
- To Introduce concept of root locus, Bode plots, Nyquist plots.
- To Introduce State Variable Analysis method.
- To get acquainted with Concepts of PLC in Industrial Automation.

Course Outcomes:

After completion of this course, students will be able to,

1. Determine and use models of physical systems in the forms suitable for use in the analysis.
2. Determine the (absolute) stability of a closed-loop control system.
3. Perform time domain analysis of control systems required for stability analysis.
4. Perform frequency domain analysis of control systems required for stability analysis.
5. Express and solve system equations in state variable form.
6. To understand the role of the PLC in Industrial automation.

Course Contents

Unit I: Introduction to Control Systems & its modeling (06 Hrs.)

Basic Elements of Control System, Open loop and Closed loop systems, Differential equations and Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph.

Unit II: Time domain analysis (06 Hrs.)

Time domain analysis: transient response and steady state response, standard test inputs for time domain analysis, order and type of a system, transient analysis of first and second order systems, time domain specifications of second order under damped system from its step response, Steady state error and static error constants.

Unit III: Stability analysis (06 Hrs.)

Characteristic equation of a system, concept of pole and zero, response of various pole locations in s-plane, concept of stability absolute stability, relative stability, stability of system from pole locations, Routh Hurwitz stability criterion, Root locus: definition, magnitude and angle conditions, construction of root locus, concept of dominant poles, effect of addition of pole and zero on root locus. Application of root locus for stability analysis.

Unit IV: Frequency domain analysis (07 Hrs.)

Frequency response and frequency domain specifications, correlation between time domain and frequency domain specifications, polar plot, Nyquist stability criterion and construction of Nyquist plot, Bode plot, determination of frequency domain specifications and stability analysis using Nyquist plot and Bode plot.

Unit V: State space representation and Controllers (07 Hrs.)

State space advantages and representation, Transfer function from State space, physical variable form, phase variable forms: controllable canonical form, observable canonical form, Solution of homogeneous state equations, state transition matrix and its properties, computation of state transition matrix by Laplace transform method only, Concept of Controller, Basic ON-OFF Controller, Concept of Dead Zone, Introduction to P, I, D, PI, PD and PID controller, OFFSET of Controller, Integral Reset, PID Characteristics.

Unit VI: Introduction of Programmable Logic Controllers (06 Hrs.)

Fundamentals of PLC, PLC selection criteria and applications of PLC, Introduction to PLC, programming, Ladder diagram, Sequential flow chart, Industrial bus systems, Case Study: Basic Ladder programming, Temperature Measurement with interfacing to DAQ

Text Books:

1. N. J. Nagrath and M. Gopal, "Control System Engineering", New Age International Publishers, 5th Edition.
2. K. Ogata, "Modern Control Engineering", Prentice Hall India Learning Private Limited; 5th Edition.

Reference Books:

1. Benjamin C. Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition.
2. M. Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition.
3. Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw-Hill.
4. John J. D'Azzo and Constantine H. Houpis, "Linear Control System Analysis and Design", Tata McGraw-Hill, Inc.
5. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley.

MOOC / NPTEL Courses:

1. NPTEL Course "Control System" https://nptel.ac.in/courses/107/106/107106081/
2. NPTEL Course "Control System Design" https://nptel.ac.in/courses/115/108/115108104/

List of Tutorials

1. Numerical on Black diagram reduction technique, Signal Flow Graphs (at least 4 numerical)
2. Computation of transfer function of Electric Circuits, Mechanical Circuits for concept understanding with their analogy Force-Voltage and Force Current.
3. Standard input signals and time response analysis of First Order and Second Order Systems for step input. Underdamped, critically damped and over damped case.
4. Stability analysis for any given system with Characteristic Equation given (Software Simulation).
5. Computation and Software / Simulation of root locus for given G(s).H(s). Comment on time domain specifications and stability of the system
6. Computation and analysis of frequency response analysis u Bode Plot for given G(s) H(s). Comment on Gain Margin, Phase Margin and Stability of the system.
7. Software implementation/Simulation frequency response analysis using Nyquist Plot for given G(s) H(s). Comment on Gain Margin, Phase Margin and Stability of the system
8. Compute correlation time domain and frequency domain with examples (at least 4 numerical).
9. Computation of State Model from Transfer function and Compute Transfer Function from state model solve at least 4/5 numerical.
10. Derivation of Properties and solve numerical on state transition matrix.
11. Observe the effect of P, PI, PD and PID controller on the step response of a feedback control system. Comment on effect of Controller mode Time domain specifications/ analysis

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ET23212:- Analog and Digital Communication

Teaching Scheme:	Credits	Examination Scheme:
Theory: 03 Hours/Week Practical: 02 Hours/Week	04	Activity:20 Marks In Sem: 20 Marks End Sem:70 Marks Practical: 20 Marks Term work: 20 Marks

Prior knowledge of

1. Basic electronic circuit analysis

is essential.

Course Objectives:

- To introduce students to AM, FM, and PM generation, transmission, and reception principles.
- To brief the impact of noise on AM, FM, and PM systems.
- To introduce students to Pulse Analog Modulation techniques.

Course Outcomes:

After completion of this course students will be able to,

CO1: Analyze and design of various continuous wave and amplitude modulation and demodulation techniques.

CO2: Analyze AM, FM signals and their spectrums.

CO3: Understand the effect of noise present in continuous wave and angle modulation techniques.

CO4: Analyze and design the various Pulse Modulation Techniques.

CO5: Understand the concepts of Digital Modulation Techniques and Baseband transmission.

CO6: Compare the power and bandwidth considerations, spectral efficiency of various Analog and Digital modulation schemes.

Course Contents

Unit I: AM Transmitter and Receiver (08 Hrs.)

Introduction to Analog Communication system, Need of modulation, Communication Channels, Amplitude Modulation principle, AM envelope, frequency spectrum, Bandwidth, Modulation index, Trapezoidal patterns. AM transmitters: Block diagram of DSBFC (Low and High level), DSBSC generation using balanced modulators, SSB generation using Phase shift & Third method.

Types of AM receiver: TRF and Super Heterodyne (block diagram) receiver, Performance characteristics of Receiver, AM detection types: Envelope detector for DSBFC, Synchronous detector for DSBSC & SSBSC.

Unit II: Angle Modulation (06 Hrs.)

Concept of Angle modulation, Instantaneous Frequency, Mathematical Expression for FM, Frequency

Spectrum, Modulation Index, Bandwidth, Narrow band & Wide band FM, Phase modulation, Generation of FM (Direct and Indirect Method), Comparison of AM, FM and PM, Pre-emphasis and De-emphasis.

Unit III: Noise (06 Hrs.)

Sources of noise, Types of noise: white noise, shot noise, thermal noise, partition noise, low frequency or flicker noise, burst noise, avalanche noise, signal to noise ratio, Noise Figure, Noise Temperature, FRISS formula for noise figure, Noise bandwidth.

Unit IV: Digital Transmission of Analog Signal (08 Hrs.)

Digital Communication System. Comparison between digital and analog communication, Sampling theorem, Sampling types, Aliasing, Generation of PAM, PWM, PPM, Uniform and Non-uniform Quantization, PCM, PCM Companding, Delta Modulation, ADM.

Unit V: Band pass Digital Modulation (06 Hrs.)

Data formats and their spectra, Digital band pass modulation techniques such as ASK, FSK, BPSK, QPSK, M-array PSK, QAM, MSK, Coherent detection of binary signals, optimum Filter, Matched Filter, Scramblers. Inter-symbol interference, Eye Diagram.

Unit VI: Spread Spectrum Techniques (06 Hrs.)

Need of SS signal, Model of spread spectrum digital communication system, Pseudo noise sequences, Notion of spread spectrum, Direct sequence spread spectrum with coherent BPSK, Processing gain, Probability of error, Concept of Jamming.

Text Books:

T1. Louis E Frenzel, "Principles of Electronic Communication Systems", Tata McGraw Hill Publications, Third Edition.
T2. Kennedy &Devis, "Electronic Communication", Tata McGraw Hill Publications.
T3. Taub Schilling, "Principles of Communication Systems", Tata McGraw Hill Fourth Edition.
T4. Simon Haykin, "Digital Communication Systems", John Wiley & Sons, Fourth Edition.
T5. B. Sklar and P.K. Ray, Digital Communication: Fundamentals and Applications, 2/e, Pearson Education, 2003.
T6. A.B Carlson, P B Crully, J C Rutledge, "Communication Systems", Fourth Edition, McGraw Hill Publication.

Reference Books:

R1. Dennis Roddy & Coolen, "Electronic Communication", Tata McGraw Hill Publications.
R2. Wayne Tomasi, "Electronic Communication Systems", Fourth Edition.
R3. Simon Haykin, "Digital Communications", Wiley Publications, Fourth Edition.
R4. Carlson, "Communication Systems", McGraw-Hill, Fourth Edition.
R5. Simon Haykin, "Analog& Digital Communications", Wiley Publications.
R6. B. Sklar, "Digital Communication", Pearson, Second Edition.
R7. Ha Nguyen, Ed Shwedyk, "A First Course in Digital Communication", Cambridge University

Press.

R7. B. P. Lathi, Zhi Ding "Modern Analog and Digital Communication System", Oxford University Press, Fourth Edition.

R8. Taub, Schilling, "Principles of Communication System", Fourth Edition, McGraw Hill.

R9. P. Ramkrishna Rao, Digital Communication, McGraw-Hill Publication.

List of Practical's

Note: Perform any 10 practical's

1. Implementation of Amplitude modulation technique to verify under, over and critical modulation using modulation index and detection.
2. Measurement of power of AM wave for different modulating signal and observe frequency spectrum.
3. Generation & Detection of DSBSC using Balanced Modulator.
4. Generation & Detection of SSB using filter method/ Phase shift method.
5. Frequency modulator & demodulator using IC 565 (PLL based VCO).
6. Verification of Sampling Theorem, PAM Techniques, (Flat top & Natural sampling), reconstruction of original signal, Observe Aliasing Effect in frequency domain.
7. Generation and Detection of PCM to understand concept sampling, quantization and encoding.
8. Practical Implementation of DM to observe slope overload distortion
9. Practical Implementation of ADM to observe Granular Noise.
10. Practical Implementation of Generation & Detection of QPSK.
11. Performance analysis of line codes (NRZ, RZ, POLAR RZ, BIPOLAR (AMI), and MANCHESTER).
12. Experimental Study of Generation &detection of DS-SS coherent BPSK & its spectrum

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ET23213:- Microcontrollers

Teaching Scheme:	Credits	Examination Scheme:
Theory: 03 Hours/Week Practical: 02 Hours/Week	04	Activity:20 Marks In Sem: 20 Marks End Sem:70 Marks Practical: 20 Marks Term work: 20 Marks

Prior knowledge of

1. Digital Logic Design
2. Electronic Components and Hardware
3. Basics of C Language.

is essential.

Course Objectives:

- Understand architecture and features of 8051 and PIC18FXX Microcontroller.
- Learn interfacing of real-world peripheral devices with microcontroller.
- Explore different features of PIC 18F Microcontroller with Architecture.
- Use concepts of timers and interrupts of PIC 18 in programming.
- Design and develop microcontroller based embedded application.
- Demonstrate real life applications using PIC 18.

Course Outcomes:

After completion of this course students will be able to,

CO1: Understand the fundamentals of microcontroller and programming.

CO2: Interface various electronic components with microcontrollers.

CO3: Analyze the features of PIC 18F XXXX.

CO4: Describe the programming details and peripheral support.

CO5: Develop interfacing models according to applications.

CO6: Evaluate the serial communication details and interfaces.

Course Contents

Unit I: Introduction to Microcontroller Architecture (06 Hrs.)

Difference between microprocessor and microcontroller Introduction Microcontroller, Features and block diagram of 8051 along with explanation, Pin Configuration, Program Status Word (PSW) 8051, Memory organization, Overview of Instruction set, addressing mode, simple assembly language programs, introduction to embedded-C

Unit II: IO Port Interfacing-I (06 Hrs.)

Port structure, 8051 Timers and modes, Hardware delay using timers, Interrupt structure, Interfacing of LEDS, Keys, 7-segment multiplexed display, stepper motor, relay, buzzer. All programs in C

Unit III: PIC 18F XXXX Microcontroller Architecture (06 Hrs.)

Comparison of PIC family, Criteria for Choosing Microcontroller, features, PIC18FXX, Architecture, Program and Data memory organization, Bank selection using Bank Select Register, Pin out diagram, Reset operations, Watch Dog Timers, Configuration registers and oscillator options (CONFIG), Power down modes, Brief summary of Peripheral support

Unit IV: Peripheral Support in PIC 18FXXXX (06 Hrs.)

Timers and its Programing (mode 0 &1), Interrupt Structure of PIC18F, Use of timers with interrupts, CCP modes: Capture, Compare and PWM generation, DC Motor speed control with CCP, Block diagram of in-built ADC with Control registers, Sensor interfacing using ADC: All programs in embedded C.

Unit V: Serial Port Programming interfacing with 18FXXXX (06 Hrs.)

Basics of Serial Communication Protocol: Study of RS232, I2C, SPI, MSSP structure, USART (Receiver and Transmitter), Interfacing of RTC (DS1307) with I2C and EEPROM with SPI. All programs in embedded C.

Unit VI: Real Word Interfacing With 18FXXXX (06 Hrs.)

Port structure with programming, Interfacing of LED, LCD and Keyboard, Motion Detectors, DAC for generation of a waveform, Design of PIC test Board, Home protection System: All programs in embedded C.

Text Books:

T1. Mahumad Ali Mazadi, Janice Gillispie Mazadi, Rolin D McKinlay, "The 8051 Microcontroller & Embedded Systems (Using Assembly and C)", PHI, 2nd Edition

T2. Mahumad Ali Mazadi, Rolin D McKinlay and Danny Causey, "PIC Microcontroller & Embedded System", Pearson Education, 3rd Edition

Reference Books:

R1. Kenneth J. Ayala, 'The 8051 Microcontroller Architecture, Programming and Applications', Cengage Learning, 3rd Edition

R2. Ajay Deshmukh, "Microcontrollers Theory and Applications", TATA McGraw Hill, 4th Edition

R3. Peatman, John B, "Design with PIC Microcontroller", Pearson Education PTE, 1st Edition

R4. Data Sheet of PIC 18Fxxxx series

MOOC/ NPTEL Course

1. **"Microcontroller and Applications" Link of the Course:**
   https://nptel.ac.in/courses/117/104/117104072/
   https://nptel.ac.in/courses/108/105/108105102/

List of Practical's

Note: 1. For Experiments No.2 to 13, develop and implement the required functionality using Embedded C programming.
2. Perform any 10 experiments.

1. Simple programs on Memory transfer (Using Assembly Language).
2. Parallel port interacting of LEDS—Different programs (flashing, Counter, BCD, HEX, Display of Characteristic).
3. Interfacing of Multiplexed 7-segment display (counting application).
4. Interfacing of Stepper motor to 8051- software delay using Timer.
5. Write a program for interfacing button, LED, relay & buzzer.
6. Interfacing of LCD to PIC 18FXXXX.
7. Interfacing of 4X4 keypad and displaying key pressed on LCD.
8. Generate a square wave using a timer with an interrupt.
9. Interfacing serial port with PC on both sides of communication.
10. Interface analog voltage 0-5V to internal ADC and display the value on LCD
11. Interface DAC to PIC 18FXXXX to generate various waveforms like square and triangular waves.
12. Generation of PWM signal for DC Motor control.
13. Interfacing of RTC using I2C protocol.

Virtual LAB Links:

http://vlabs.iitb.ac.in/vlabs-dev/labs/8051-Microcontroller-Lab/labs/index.php

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ET23214:- Electromagnetic Field Theory

Teaching Scheme:	Credits	Examination Scheme:
Theory: 03 Hours/Week	03	Activity:20 Marks In Sem: 20 Marks End Sem:70 Marks

Prior knowledge of

1. Vectors, Vector Calculus
2. Coordinate Geometry, Cartesian, Cylindrical, Spherical

is essential.

Course Objectives:

- Provide the foundation and rudiments of Electromagnetic theory essential to subsequent courses of radiation, microwave and wireless communications.
- Expose the students to basic laws of electro statics, magneto statics leading to the Maxwell Equations for static and dynamic fields.
- Extend these laws to Uniform Plane waves, transmission line theory and some of the case studies of applications of engineering electromagnetic field theory.
- The main focus will be on the physical interpretation of all the mathematical formulations and extend these concepts to real time applications in the field Electronics and Telecommunication Engineering.

Course Outcomes:

After completion of this course students will be able to,

CO1: Apply the basic electromagnetic principles and determine the fields (E & H) due to the given source.

CO2: Apply boundary conditions to the boundaries between various media to interpret behavior of the fields on either sides.

CO3: State, Identify and Apply Maxwell's equations (integral and differential forms) in both the forms (Static, time-varying or Time-harmonic field) for various sources, Calculate the time average power density using Poynting Theorem, Retarded magnetic vector potential.

CO4: Formulate, Interpret and solve simple uniform plane wave (Helmholtz Equations) equations, and analyze the incident/reflected/transmitted waves at normal incidence.

CO5: Interpret and Apply the transmission line equation to transmission line problems with load impedance to determine input and output voltage/current at any point on the Transmission line, Find input/load impedance, input/load admittance, reflection coefficient, SWR, Vmax/Vmin, length of transmission line using Smith Chart.

CO6: Understand the power flow mechanism in guiding structures and in unbounded medium

Course Contents

Unit I: Electrostatics (06 Hrs.)

Review of 3D Coordinate Geometry, Vector Calculus, Physical significance of Gradient, Divergence, Curl, Electric field intensity(E), Displacement Flux Density(D), Gauss's law, Electric potential(V), Potential Gradient, E/D/V due to uniform sources (point charge, infinite line charge, infinite surface charge) , Maxwell Equations for Electrostatics, Current, Current Density, physical interpretation.

Application Case Study: Electrostatic Discharge, Cathode Ray Oscilloscope.

Unit II: Magneto statics (06 Hrs.)

Lorentz force, magnetic field intensity (H), Magnetic Flux Density(B), – Biot–Savart's Law – Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Maxwell Equations for Magneto Statics, physical interpretation.

Application Case Study: Lightning, Magnetic Resonance Imaging (MRI).

Unit III: Boundary Conditions (06 Hrs.)

Electric Dipole, Dielectric Polarization, Properties of Conductors, Dielectric Materials, Boundary conditions (dielectric-dielectric, conductor –dielectric), significance and applications of Poisson's and Laplace's equations - Capacitance, Energy density. Magnetization, magnetic materials, Boundary conditions for Magnetic Fields, Magnetic force, Torque.

Application Case Study: RF MEMS, Magnetic Levitation, Electromagnetic Pump.

Unit IV: Time Varying Electromagnetic Fields: Maxwell Equations (06 Hrs.)

Scalar and Vector Magnetic Potential, Poisson's and Laplace Equations, Faraday's law, Translational and motional emf, Displacement current density, Continuity Equation, Time varying Maxwell's equations - point form, integral form, Power and Poynting theorem, concept of Retarded magnetic vector potential,

Application Case Study: Memristor, Electric Motors, Generators.

Unit V: Uniform Plane Waves & Transmission Line Theory (06 Hrs.)

Maxwell's equation using phasor notations, Electromagnetic wave equations (Helmholtz equation), Relation between E and H, depth of penetration, concept of polarization, Reflection by perfect conductor-normal incidence, reflection by perfect dielectric- normal incidence, Snell's law, Line parameters, skin effect, general solution, physical significance of the equations, wavelength, velocity of propagation, the distortion less line, Reflection on a line not terminated in Z0, reflection coefficient, open and short circuited lines, reflection coefficient and reflection loss, standing waves; nodes; standing wave ratio, Input impedance of dissipation less line, Smith Chart and its applications in solving the transmission line parameters.

Unit VI: Guided Waves (06 Hrs.)

Waves between parallel planes, TE and TM waves, Characteristics of TE and TM waves, TEM waves, Velocities of propagation, Attenuation in parallel plane guides, Wave impedance, Electric field and current flow within the conductor.

WAVE GUIDES: Rectangular wave-guides, TE and TM modes in wave-guides, Velocity, wavelength, Impedance and attenuation in rectangular waveguides.

Text Books:

T1. M.N.O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", Oxford University Press, India, 2015 (Asian adaptation of 'M.N.O. Sadiku, Elements of Electromagnetics, Sixth International Edition, Oxford University Press'), 6th Edition

T2. William H. Hayt and John A. Buck, "Engineering Electromagnetics", Tata McGraw Hill, 8th Revised Edition.

Reference Books:

3. Kraus and Fleish, "Electromagnetics with Applications", McGraw Hill International Editions, 5th Edition.
4. Jordan and Balmain, "Electromagnetic Waves and Radiating Systems", PHI, 1964.

MOOC/ NPTEL Course

1. NPTEL Course "Transmission Lines and EM Waves -Video course" Prof. R.K. Shevgaonkar
Link of the Course: https://nptel.ac.in/courses/117/101/117101056/
2. NPTEL Course on "Electromagnetic theory - Video course" Dr. Pradeep Kumar K
Link of the Course: https://nptel.ac.in/courses/108/104/108104087/
3. David Staelin. 6.013 Electromagnetics and Applications. Spring 2009. Massachusetts Institute of Technology: MIT Open Course Ware
Link: https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-013-electromagnetics-and-applications-spring-2009/index.htm#

SD Biradar	Dr. BH Patil	Dr. SM Bhosle	Dr. RS Bichkar
Autonomy Coord.	HoD – E&TC	Dean Academics	Principal

VPKBIET BARAMATI
PUNE (MS.)

ET23215:- Vocational and Skill Enhancement Course (VSC): Programming in Python

Teaching Scheme:	Credits	Examination Scheme:
Practical: 04 Hours/Week	02	Practical: 20 Marks Term work: 40 Marks

Course Objectives:

- To introduce to student's fundamentals of data science.
- To introduce to students various Python packages related to data science.
- To make students write Python programs related to data sequences using NumPy and Pandas.
- To make students write Python programs related to data frames using NumPy and Pandas.

Course Outcomes:

After completion of this course, students will be able to,

1. Develop the application specific codes using python
2. Apply modular approach in python programs
3. Implement Digital logic gates using Python
4. Analyze electronic circuits using SPICE interface

Guidelines for Instructor's Manual

Guidelines for Laboratory Conduction During each lab experiment the following activities will be carried out:

- The instructor will explain the aims & objectives of the assignments.
- The instructor will explain the topics required to carry out the experiment.
- The students will do the hands on as per the Lab manual & Web resources provided.
- The students will show the results to the instructor.

Guidelines for Student's Lab Journal

The student's Lab Journal can be submitted in the form of a soft copy/hard copy. In case of soft copy submission, the print out of only the first page can be kept in the Journal. It should include the following as applicable: Assignment No, Title of Assignment, Date of Performance, Date of Submission, Aims & Objectives, Theory, and Description of data used, Results, and Conclusion.

Guidelines for Lab /TW Assessment

The oral examination will be based on the work carried out by the student in the Lab course.

Suitable rubrics can be used by the internal & external examiner for assessment.

Detailed Syllabus

Expressions, Data types, Variables, Flow Control concepts, While Loops, For Loops Functions: Builtin functions, Writing own functions, Global and local scopes, Error handling Lists, For loops with lists, multiple assignment and augmented operators, List methods Dictionary Data type and Data structures, string syntax, string methods, String formatting Regular expressions: Basics, Groups, Character classes, Repetition in Regex patterns, Regex method Files Reading and writing, copying and moving, deleting, Directory tree Pyspice, Numpy, Pandas, Data visualization libraries, Jupyter Notebook, Python IDEs

1	**Multi-D Lists:** Write a program that defines a matrix and prints
2	Write a program to perform addition of two square matrices
3	Write a program to perform multiplication of two square matrices
4	**Digital Logic** : Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
5	**SPICE Interface:** Write a program to design RLC circuit using SPICE interface.
6	**Device Characteristics** Write a program to find the diode V-I characteristics using SPICE interface.
7	Write a program to find the transistor V-I characteristics using SPICE interface.
8	**Electronic Circuits:** Write a program to design diode circuits (rectifier, clipper, clamper, regulator) using SPICE interface.
9	Write a program to design the FET based amplifier circuits using SPICE interface.

Text Books:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Learning Python, Mark Lutz, Orielly

Reference Books:

1. Think Python, Allen Downey, Green TeaPress
2. Core Python Programming, W.Chun, Pearson
3. Introduction to Python, Kenneth A. Lambert, Cengage

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