KARNATAK LAW SOCIETY'S

GOGTE INSTITUTE OF TECHNOLOGY

UDYAMBAG, BELAGAVI-590008

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

(APPROVED BY AICTE, NEW DELHI)

Department of Electronics and Communication Engineering

Scheme and Syllabus

4th Semester B.E.

INSTITUTION VISION

Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills.

MISSION

To train the students to become Quality Engineers with High Standards of Professionalism and Ethics who have Positive Attitude, a Perfect blend of Techno-Managerial Skills and Problem solving ability with an analytical and innovative mindset.

QUALITY POLICY

- Imparting value added technical education with state-of-the-art technology in a congenial, disciplined and a research oriented environment.
- Fostering cultural, ethical, moral and social values in the human resources of the institution.
- Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education.

DEPARTMENT VISION

The Electronics & Communication Engineering department shall impart quality technical education and entrepreneurship skills to develop creative individuals to face changing global scenario.

MISSION

To augment the national talent pool, with Electronics and Communication Engineers having all-encompassing technical knowledge, principled practices and nationalistic outlook.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. The graduates will acquire core competence in basic science and Electronics and Communication Engineering fundamentals necessary to formulate, analyze, and solve engineering problems and to pursue advanced study or research.
2. The graduates will engage in the activities that demonstrate desire for ongoing personal and professional growth and self-confidence to adapt to rapid and major changes.
3. The graduates will maintain high professionalism and ethical standards, effective oral and written communication skills, work as part of teams on multidisciplinary projects under diverse professional environments, and relate engineering issues to the society, global economy and to emerging technologies.

PROGRAM OUTCOMES (POs)

1. **Fundamentals of Engineering:** Graduates shall be able to understand and apply the basic mathematical and scientific concepts in the field of Electronics and Communication Engineering.
2. **Design of Experiments:** Graduates shall possess the ability to design and conduct experiments, analyse and interpret data.
3. **Social Engineering:** Graduates shall possess the ability to identify societal problems and meaningfully contribute with optimal solutions.
4. **Engineering Cognizance:** Graduates shall be able to stay abreast with recent developments in the field of Electronics and Communication Engineering.
5. **Modern tool Usage:** Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures.
6. **Impact of Engineering:** Graduates shall be able to understand the impact of engineering solutions in a global, economic, environmental and societal context.
7. **Ethics:** Graduates shall imbibe the professional and ethical responsibilities of their profession.
8. **Collaboration:** Graduates shall have the ability to collaborate productively in multidisciplinary teams with leadership attributes.
9. **Soft skills**: Graduates shall possess proficiency in oral and written communication skills.
10. **Entrepreneurship**: Graduates shall imbibe project management and finance skills to pursue entrepreneurial endeavours.
11. **Research and Innovation:** Graduates shall have the ability to pursue research and provide innovative solutions.
12. **Self motivated Learning:** Graduates shall continue to upgrade the skills and possess the motivation for continuing education and professional growth.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Understanding and applying the mathematical and scientific concepts, for analysis and design of basic Electronics and Communication systems.
2. Developing critical thinking abilities coupled with competence in use of computational tools for professional growth; complimented with communication skills and leadership attributes.
3. Identifying societal needs and sensitizing individuals towards finding innovative solutions to contemporary issues with multidisciplinary outlook.

Scheme of Teaching
Semester IV

S. No.	Code	Course		Credits L – T - P	Total credits	Contact Hours/ week	Marks CIE	Marks SEE	Marks Total
1.	MATEE41	Engineering Mathematics -IV	BS	3 – 1 – 0	4	5	50	50	100
2.	EC42	Computer Organization and Architecture	PC1	3 – 0 – 0	3	3	50	50	100
3.	EC43	Communication Theory and Techniques	PC2	3 – 0 – 0	3	3	50	50	100
4.	EC44	Fields and Waves	PC3	4 – 0 – 0	4	4	50	50	100
5.	EC45	Linear Integrated Circuits	PC4	4 – 0 – 0	4	4	50	50	100
6.	EC46	Digital Design using HDL	PC5	4 – 0 – 0	4	4	50	50	100
7.	ECL47	LIC and Control Systems Lab	L1	0 – 0 – 1.5	1.5	3	25	25	50
8.	ECL48	Communication Lab	L2	0 – 0 – 1.5	1.5	3	25	25	50
9.	BCMAT41*	Bridge course Maths –II (Diploma)	BS	Mandatory Course	0	2	50	50	100
		Total			**25**	**29 (31)**	**350 (400)**	**350 (400)**	**700 (800)**

*Students have to pass Bridge course Mathematics – II (BCMAT41) before advancing to 7th semester

Engineering Mathematics - IV

Course Code	MATEE41	**Credits**	4
Course type	BS	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 1 – 0	**SEE Marks**	50 marks
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives (CLOs)

1. Learn the concept of Interpolation and use appropriately.
2. Understand the concept of Partial Differential Equations and their applications.
3. Understand Complex valued functions and get acquainted with Complex Integration and construction of series.
4. Get acquainted with Sampling Distribution and Testing of Hypothesis.
5. Study the concept of Fourier Transforms, Z transforms and its applications.

Pre-requisites:

1. Partial Differentiation.
2. Basic Probability and Probability Distribution.
3. Matrix operations.
4. Basic Integration.

Unit – I **10 Hours**

Finite differences and Interpolation: Forward and Backward differences, Newton's Forward and Backward Interpolation Formulae, Divided Difference, Newton's Divided Difference Formula (without proof), Lagrange's Interpolation Formula, Illustrative examples, Numerical Integration: Newton- Cotes Quadrature formula, Trapezoidal rule, Simpsons $1/3^{rd}$ rule, Simpsons $3/8^{th}$ rule, Weddle's rule, Practical Examples.

Unit – II **10 Hours**

Partial Differential Equations: Formation of PDE by elimination of arbitrary constants and Functions, Solution of non homogeneous PDE by direct integration, Solution of homogeneous PDE involving derivative with respect to one independent variable only.

Applications of Partial Differential Equations: Derivation of one dimensional Heat and Wave equations. Solutions of one dimensional Heat and Wave equations, two dimensional Laplace equation by the method of separation of variables. Numerical solution of one dimensional Heat and Wave equations, two dimensional Laplace equation by finite differences.

Unit – III **10 Hours**

Complex Analysis: Functions of complex variable w = f(z). Analytic functions, Harmonic function and properties, Cauchy–Reimann equations in Cartesian coordinates (without proof), Derivatives of e^z, logz and sinz, Construction of Analytic functions, Milne–Thomson method, Complex Integration, Cauchy's Theorem, Cauchy's Integral formula (without proof), Taylor's and Laurent's series (without proof), Singularities, Poles, Residues, Examples, Cauchy's Residue Theorem (Statement and examples), Applications to Flow problems.

Unit – IV **10 Hours**

Sampling distribution and Testing of Hypothesis: Sampling, Sampling distribution, Sampling distribution of means, Level of significance and confidence limits, tests of significance for small and large samples, 't' and 'chi square' distributions, Practical examples.

Unit – V **10 Hours**

Fourier Transform: Infinite Fourier Transform and Properties, Fourier Sine and Cosine Transforms, Properties and Problems.

Z -Transform: Definition, Standard Z transforms, Linearity, Damping rule, Shifting properties, Initial and Final value Theorems-Examples, Inverse Z transforms and Solution of Difference Equations by Z transforms.

Text Books

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edn. (onwards), 2012.
2. P.N.Wartikar and J.N.Wartikar, "Applied Mathematics" (Volume I and II), Pune Vidyarthi Griha Prakashan, 7th Edn. (onwards), 1994.
3. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill Publishing Company Ltd., 43rd Edn. (onwards), 2006.

Reference Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Inc., 9th Edn. (onwards), 2006.
2. Peter V. O' Neil, "Advanced Engineering Mathematics", Thomson Brooks/Cole, 7th Edn. (onwards), 2011.
3. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 4th Edn. (onwards), 2010.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Use Finite differences in Interpolation.	L3
2. Form and Solve Partial differential Equations.	L2, L3
3. Develop Heat, Wave equations and solve them using Numerical methods	L3
4. Discuss Complex valued functions, Complex Integration and Construct Infinite series of complex valued functions.	L2, L3
5. Test the Hypothesis and Solve problems related to them.	L2, L3
6. Apply Fourier and Z- Transforms for Engineering problems.	L3

Program Outcome of this course (POs)	PO No.
1. **Fundamentals of Engineering:** Graduates shall be able to understand and apply the basic mathematical and scientific concepts in the field of Electronics and Communication Engineering.	1
2. **Modern tool Usage:** Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures.	5
3. **Research and Innovation:** Graduates shall have the ability to pursue research and provide innovative solutions.	11

Course delivery methods	Assessment methods
1. Classroom Teaching (Blackboard)	1. IA test
2. Presentation	2. Assignment
3. Video presentations	3. Quiz
	4. Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	Average of best two IA tests out of three	**Average of assignments (Two) / activity**	**Quiz**	Class participation	Total Marks
Maximum Marks: 50	25	10	5	10	50
➢ Writing two IA tests is compulsory. ➢ **Minimum marks required to qualify for SEE :** 20					

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:** 40
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

Computer Organization and Architecture

Course Code	EC42	**Credits**	3
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	35	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives (CLOs)

1. To have a thorough understanding of the basic structure and operation of a digital computer.
2. To understand the operation of the arithmetic unit including the algorithms and Implementation of fixed-point and floating-point arithmetic operations.
3. To learn the concepts behind advanced pipelining and vector processing techniques.
4. To study the different ways of communicating with I/O devices and standard I/O interfaces.
5. To understand the current state of art in memory system design.

Pre-requisites :

1. Basic Electronics (ELN15/25).
2. Digital Electronic Circuits (EC36).

Unit – I 7 Hours

Data Representation: Data Types, Complements, Fixed-point Representation, Floating-point Representation, Other Binary Codes.
Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic, Logic, Shift Micro operations, Arithmetic Logic Shift Unit.
Self learning topics: Error Detection Codes.

Unit – II 7 Hours

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.
Micro-programmed Control: Control Memory, Address Sequencing, Micro-program Example, Design of Control Unit.

Unit – III 7 Hours

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC).
Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline.
Self learning topics: Vector Processing, Array Processors.

Unit – IV 7 Hours

Computer Arithmetic: Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating-Point Arithmetic Operations, Decimal Arithmetic Unit, Decimal Arithmetic Operations.
Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor (IOP), Serial Communication.

Unit - V **7 Hours**

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Multiprocessors: Characteristic of Multiprocessors, Interconnection Structures, Inter-processor Arbitration, Inter-processor Communication and Synchronization, Cache Coherence.

Text Books

1. Morris Mano, "Computer System Architecture", PHI, 2002, 3rd Edn. (onwards), ISBN: 81-203-0855-7.
2. Carl Hamacher, "Computer organization", McGraw-Hill Inc., 5th Edn. (onwards), 1996.

Reference Books

1. William Stallings, "Computer organization and Architecture", Pearson Education, 6th Edn. (onwards) 2003.
2. John P. Hayes, "Computer Architecture and Organization", Tata Mc.Graw Hill, 3rd Edn. (onwards), 1998.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Explain the generic principles that underlie the design of digital computer, including data representation, digital logic and process simulation.	L2
2. Describe the structure and functioning of a digital computer, including its overall system architecture, operating system, and digital components.	L2
3. Apply and Implement fundamental coding schemes.	L3
4. Understand the organization of the Control unit, Arithmetic and Logical unit, Memory unit and the I/O unit	L2
5. Understand the evolution of processors, their present technology and inter-process communication.	L2

Program Outcome of this course (POs)	PO No.
1. **Fundamentals of Engineering:** Graduates shall be able to understand and apply the basic mathematical and scientific concepts in the field of Electronics and Communication Engineering.	1
2. **Modern tool Usage:** Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures.	5
3. **Self motivated Learning:** Graduates shall continue to upgrade the skills and possess the motivation for continuing education and professional growth.	12

Course delivery methods	Assessment methods
1. Classroom Teaching (Blackboard)	1. IA test
2. Presentation	2. Assignment
3. Video presentations	3. Quiz
4. Group Discussion	4. Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	Average of best two IA tests out of three	**Average of assignments (Two) / activity**	**Quiz**	Class participation	Total Marks
Maximum Marks: 50	25	10	5	10	50
➢ Writing two IA tests is compulsory. ➢ **Minimum marks required to qualify for SEE :** 20					

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:** 40
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

Communication Theory and Techniques

Course Code	EC43	**Credits**	3
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	35	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives (CLOs)

1. To revisit the basic signal processing concepts in frequency domain.
2. To understand the theoretical concept of various amplitude modulation techniques.
3. To discuss the design and working of angle modulation systems.
4. To comprehend noise in communication systems.
5. To discuss the effect of noise in analog communication systems.
6. To understand the working of television.

Pre-requisites :

1. Signals and Systems (EC34).
2. Analog Electronic Circuits (EC35).

Unit – I **7 Hours**

Amplitude Modulation Systems: Review of Spectral Characteristics of Periodic and Non-periodic signals, Generation and Demodulation of AM, DSBSC, SSB and VSB Signals. Frequency Translation, FDM, Non – Linear Distortion.

Self learning topics: Comparison of Amplitude Modulation Systems.

Unit – II **7 Hours**

Angle Modulation Systems: Phase and Frequency Modulation. Single tone Narrow Band and Wideband FM, Transmission Bandwidth, Generation and Demodulation of FM Signal.

Unit – III **7 Hours**

Noise Theory: Review of Probability, Random Variables and Random Process, Gaussian Process, Noise – Shot noise, Thermal noise and White noise, Narrow band noise, Noise temperature, Noise Figure.

Unit – IV **7 Hours**

Performance of CW modulation systems: Super heterodyne Radio receiver and its characteristic, SNR, Noise in DSBSC systems using coherent detection, Noise in AM system using envelope detection and its FM system, FM threshold effect, Pre-emphasis and De-emphasis in FM.

Self learning topics: Comparison of performances of effect of noise in CW modulation systems.

Unit – V **7 Hours**

Television Engineering: Elements of Colour TV, Frequency range and channel bandwidth, scanning and synchronization, composite video signal. Block diagram of transmitter and receiver.

Text Books

1. Simon Haykin, "An Introduction to Analog and digital Communications", John Wiley, 2nd Edn. (onwards), 2004.
2. B. P.Lathi, "Modern Digital and Analog Communication Systems", Oxford, 3rd Edn. (onwards), 1998.
3. R.R.Gulati, "Monochrome and Colour Television", New Age International, 3rd Edn. (onwards), 2006.

Reference Books

1. Dennis Roddy and John Coolen, "Electronic Communication", Prentice Hall of India, 4th Edn. (onwards), 1995.
2. Herbert Taub and Donald L Schilling, "Principles of Communication Systems", Tata McGraw Hill, 3rd Edn. (onwards), 2008.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Explain and compare various amplitude and angle modulation techniques.	L2, L4
2. Analyze the working of AM and FM transmitters and receivers.	L4
3. Discuss the effect of noise in communication systems.	L3
4. Analyze the performance of analog communication systems.	L4
5. Explain the working of television.	L2

Program Outcome of this course (POs)	PO No.
1. **Fundamentals of Engineering:** Graduates shall be able to understand and apply the basic mathematical and scientific concepts in the field of Electronics and Communication Engineering.	1
2. **Design of Experiments:** Graduates shall possess the ability to design and conduct experiments, analyse and interpret data.	2
3. **Engineering Cognizance:** Graduates shall be able to stay abreast with recent developments in the field of Electronics and Communication Engineering.	4
4. **Modern tool Usage:** Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures.	5
5. **Self motivated Learning:** Graduates shall continue to upgrade the skills and possess the motivation for continuing education and professional growth.	12

Course delivery methods	Assessment methods
1. Blackboard Teaching	1. Internal Assessment
2. Presentation	2. Quiz
3. Videos	3. Assignment

Scheme of Continuous Internal Evaluation (CIE):

Components	Average of best two IA tests out of three	**Average of assignments (Two) / activity**	**Quiz**	Class participation	Total Marks
Maximum Marks: 50	25	10	5	10	50
➢ Writing two IA tests is compulsory. ➢ **Minimum marks required to qualify for SEE :** 20					

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:** 40
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

Fields and Waves

Course Code	EC44	**Credits**	4
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	45	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives (CLOs)

1. To infer basic concepts of radio wave propagation.
2. To develop a comprehensive and rigorous treatment of the fundamentals of static electric fields.
3. To discuss the fundamentals of static magnetic fields and develop Maxwell's equations. Also to compare and address the analogous nature of Maxwell's equations for static electric and magnetic fields.
4. To build and understand Maxwell's equations both in point and integral form for electrodynamics.
5. To formulate the concepts leading to basic wave equation and properties of wave travelling in free space, dielectrics and conductor in various configurations.

Pre-requisites :

1. Engineering Physics (PHY12).
2. Engineering Mathematics (MAT31).

Unit – I 9 Hours

Propagation Characteristics of Radio Waves (Application of Fields& Waves): EM Wave Spectrum, The ionosphere, Virtual height & Critical frequency, Maximum Usable Frequency (MUF), Effect of earth's magnetic field, Skip distance, Ionospheric behavior variations, Sky wave propagation, Great circle distances on earth, Ground wave propagation, Space wave propagation, Space wave propagation affected by atmosphere, Propagation characteristics of radio waves, short waves, VHF, UHF and microwaves, Tropospheric scatter propagation.

Unit – II 9 Hours

Introduction to Static Electric Fields: Vector analysis, Co-ordinate systems and transformations, Coulomb's law, Electric Field Intensity (EFI), EFI due to various charge configurations (line charge, surface charge and volume charge), Electric Flux Density (EFD), Gauss' Law & its applications, Gauss's Law in Point form, Divergence Theorem. Energy spent in moving charge, Definition of Potential Difference and Potential, Potential field due to Point Charge and System of Charge, Potential gradient, The dipole, Energy Density. Boundary conditions of static electric field at the interface of materials, Laplace and Poisson's equations, Uniqueness Theorem.

Unit – III 9 Hours

Introduction to Static Magnetic Fields: Biot-Savart's Law, Ampere's circuital law, Curl, Stokes Theorem, Magnetic Flux, Flux Density, Scalar and Vector Magnetic Potentials Magnetic forces, Force on a moving charge, Force on differential current element, Magnetic Boundary Condition, Energy stored in magnetic field

Unit – IV **9 Hours**

Time Varying Fields and Maxwell's Equations: Faraday's Law, Continuity equation for time varying field, Displacement Current, Maxwell's correction to Ampere's Circuit Law, Summary of Maxwell's Equations in Point, Integral and Harmonic form, Retarded Potentials Wave equations, UPW (TEM wave) propagation in free space, dielectrics and good conductors (including derivations of the parameters involved).

Unit – V **9 Hours**

Poynting vector: Poynting's Theorem, Instantaneous, Average and Complex Poynting vector, Power loss in a plane conductor, Wave Power, Polarization.

Plane waves: Reflection of UPW at normal incidence, at multiple interfaces and at oblique incidence angles, Total reflection**.**

Text Books

1. William H.Hayt Jr. and John A. Buck, "Engineering Electromagnetics", Mc.Graw-Hill Education, 2nd Edn. (onwards), 2014.
2. V. V. Sarwate, "Electromagnetic Fields and Waves", Wiley Eastern Limited, 1st Edn. (onwards), 1993.
3. Joseph A. Edminister, "Theory and Problems on Electromagnetics", Schaum's outline series, Mc.graw-Hill, 2nd Edition (onwards), 1993**.**

Reference Books

1. Matthew N. O. Sadiku, "Elements of Electromagnetics", Oxford University Press, 6th Edn. (onwards), 2014.
2. David K. Cheng, "Field and Wave Electromagnetics", Pearson Education Asia, 2nd Edn. (onwards), 1989.
3. E. C. Jordan and K. G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall, Inc., 2nd Edn. (onwards), 1968.
4. John D. Kraus and Daniel A. Fleisch, "Electromagnetics with Applications", McGraw-Hill, 5th Edn. (onwards), 1999.

Other Resources

1. http://ocw.mit.edu/resources/res-6-002-electromagnetic-field-theory-a-problem-solving-approach-spring-2008/
2. http://www.nptelvideos.in/2012/11/electro-magnetic-fields.html
3. http://emt-iiith.vlabs.ac.in/experiments.php
4. Robert Feynman Lectures
5. http://www.maxwells-equations.com/

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	Explain and compare various free space propagation modes.	L2
2.	Define, understand and explain concepts on electrostatics and also apply to solve numerical problems on various configurations of distribution of electric charges.	L1, L2, L3
3.	Explain the concepts of magnetostatics.	L2
4.	Summarize and solve Maxwell equations for time-varying electric and magnetic fields.	L3, L4
5.	Explain and analyze EM wave propagation and understand the power flow mechanism in guiding structures and in unbounded media.	L3

	Program Outcome of this course (POs)	PO No.
1.	**Fundamentals of Engineering:** Graduates shall be able to understand and apply the basic mathematical and scientific concepts in the field of Electronics and Communication Engineering.	1
2.	**Engineering Cognizance:** Graduates shall be able to stay abreast with recent developments in the field of Electronics and Communication Engineering.	4
3.	**Modern tool Usage:** Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures.	5
4.	**Impact of Engineering:** Graduates shall be able to understand the impact of engineering solutions in a global, economic, environmental and societal context.	6
5.	**Self motivated Learning:** Graduates shall continue to upgrade the skills and possess the motivation for continuing education and professional growth.	12

Course delivery methods	Assessment methods
1. Blackboard Teaching	1. Internal Assessment
2. PPT's	2. Quiz
3. Videos	3. Assignment
4. Animations	4. Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	Average of best two IA tests out of three	**Average of assignments (Two) / activity**	**Quiz**	Class participation	Total Marks
Maximum Marks: 50	25	10	5	10	50
➢ Writing two IA tests is compulsory. ➢ **Minimum marks required to qualify for SEE :** 20					

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:** 40
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

Linear Integrated Circuits and Applications

Course Code	EC45	**Credits**	4
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	45	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives (CLOs)

1. To learn the basic concepts of operational amplifier.
2. To study the parameters and frequency response of an op-amp and related concepts.
3. To learn various linear applications of op-amp.
4. To study the working of active filters, oscillators and generator circuits.
5. To study comparators, DACs, ADCs using general purpose op-amp and applications of Specialized ICs.

Pre-requisites :

1. Basic Electronics (ELN15/25).
2. Analog Electronic Circuits (EC32).
3. Digital Electronic Circuits (EC36).

Unit – I 9 Hours

Introduction to Operational Amplifiers: Introduction, The Operational Amplifier, Block Diagram Representation, Schematic Symbol, Integrated Circuits, Power Supplies for Integrated Circuits, Interpreting a Typical Set of Data Sheets, The Ideal Op-Amp, Equivalent Circuit of an Op-Amp, Ideal Voltage Transfer Curve.

Open-Loop Op-Amp Configurations: Differential Amplifier, Inverting Amplifier, Non-inverting Amplifier, Differential Amplifier with One and Two Op-Amps, Numerical Problems.

Unit – II 9 Hours

The Practical Op-Amp: Introduction, Input Offset Voltage, Input Bias Current, Input Offset Current, Total Output Offset Voltage, Thermal Drift, Common-Mode Configuration, Common-Mode Rejection Ratio.

Frequency Response of an Op-Amp: Introduction, Frequency Response, Compensating Networks, High-Frequency Op-Amp Equivalent Circuit, Closed-Loop Frequency Response, Circuit Stability, Slew Rate, Numerical Problems.

Unit – III 9 Hours

General Linear Applications: Introduction, DC and AC Amplifiers, AC Amplifiers with a Single Supply Voltage, the Peaking Amplifier, Summing, Scaling and Averaging Amplifiers: Inverting, Non-inverting and Differential Configurations, Instrumentation Amplifier, Precision Rectifiers, Differential Input and Differential Output Amplifier, Voltage-to-Current Converter with Floating Load, Voltage-to-Current Converter with Grounded Load, Current-to-Voltage Converter, Very High Input Impedance Circuit, The Integrator, The Differentiator, Numerical Problems.

Unit – IV **9 Hours**

Active Filters and Oscillators: Introduction, Active Filters, First-Order Low-Pass Butterworth Filter, Second-Order Low-Pass Butterworth Filter, First-Order High-Pass Butterworth Filter, Second-Order High-Pass Butterworth Filter, Band-Pass Filters, Band-Reject Filters, All-Pass Filter, Oscillators, Phase-Shift Oscillator, Wien Bridge Oscillator, Quadrature Oscillator, Square Wave Generator, Triangular Wave Generator, Saw-tooth Wave Generator, Voltage-Controlled Oscillator, Numerical Problems.

Unit – V **9 Hours**

Comparators and Converters: Introduction, Basic Comparator, Zero-Crossing Detector, Schmitt Trigger, Comparator Characteristics, Limitations of Op-Amps as Comparators, Voltage Limiters, Analog-to-Digital and Digital-to-Analog Converters, Clippers and Clampers, Absolute-Value Output Circuit, Peak Detector, Sample-and-Hold Circuit.

The 555 Timer: Monostable Multivibrator and Applications, Astable Multivibrator and Applications, Phase-Locked Loops, Voltage Regulators: Fixed Voltage Regulators, Adjustable Voltage Regulators, Numerical Problems.

Text Books

1. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Prentice Hall Inc., 4th Edn. (onwards), 2002.

Reference Books

1. Robert F. Coughlin and Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", PHI, 4th Edn. (onwards), 2000.
2. D. Roy Choudhury and Shail B. Jain, "Linear Integrated Circuits", New Age International, 3rd Edn. (onwards), 2008.
3. David A. Bell, "Operational Amplifiers and Linear IC's", Prentice Hall Inc., 2nd Edn. (onwards), 2004.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Describe the block diagram, schematic, general characteristics of an op-amp and to extract the op-amp characteristics from data sheet.	L1, L2
2. Differentiate between an ideal and practical op-amp and explain the frequency response of an op-amp.	L2, L3
3. Analyze and explain the general linear applications of op-amp circuits such as inverter, summer, subtractor, integrator, and differentiator.	L3
4. Illustrate the analysis and design of active filters and various oscillators and generators.	L2, L3
5. Describe the operation of Comparator, Schmitt trigger, Converters, Sample and Hold circuit and appreciate the use of specialized ICs and their applications.	L1, L2

Program Outcome of this course (POs)	PO No.
1. **Fundamentals of Engineering:** Graduates shall be able to understand and apply the basic mathematical and scientific concepts in the field of Electronics and Communication Engineering.	1
2. **Design of Experiments:** Graduates shall possess the ability to design and conduct experiments, analyze and interpret data.	2

Course delivery methods	Assessment methods
1. Blackboard	1. Internal Assessment Tests
2. Presentations	2. Quiz
3. Animations	3. Assignments

Scheme of Continuous Internal Evaluation (CIE):

Components	Average of best two IA tests out of three	**Average of assignments (Two) / activity**	**Quiz**	Class participation	Total Marks
Maximum Marks: 50	25	10	5	10	50
➢ Writing two IA tests is compulsory. ➢ **Minimum marks required to qualify for SEE :** 20					

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:** 40
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

Digital Design using HDL

Course Code	EC46	**Credits**	4
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	45	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives (CLOs)

1. Appreciate the importance of HDL in digital designs.
2. Understand program flow of Verilog HDL at data flow; gate level, structural, behavioral and RTL levels.
3. Model, program and develop test bench for combinational circuits, Programmable Logic Devices (PLDs) and synchronous sequential circuits.
4. To provide insight into the architecture of FPGAs and programming on FPGAs.
5. To introduce to the fundamental concept of SystemVerilog and basic programming with examples.

Pre-requisites :
Digital Electronic Circuits (EC36).

Unit - I 9 Hours

Introduction: Introduction to HDL, A brief History of HDL, Structure of HDL Modules, Operators, Data Types, Types of Descriptions (Data- Flow, Behavioral and Structural, Switch level), Simulation and Synthesis.
Combinational Circuits Building Blocks: Code Converters, Arithmetic Comparison Circuits, Verilog for combinational circuits.
Self learning topics: Multiplexers, Decoders, Encoders.

Unit - II 9 Hours

Flip-Flops, Registers, Counters: Basic Latch, Gated D Latch, Edge-Triggered D Flip-Flops Flip-Flop, JK Flip-Flop, Registers, Counters, Reset synchronization, other types of counters: BCD Counter, Blocking and Non-Blocking, Non-Blocking Assignments for Combinational Circuits, Flip-Flops with Clear Capability.
Self learning topics: Ring counter, Johnson counter.

Unit - III 9 Hours

Synchronous Sequential Circuits: Basic Design Steps, State-Assignment Problem, Mealy State Model, Design of Finite State Machines Using CAD Tools, Serial Adder Example, State Minimization, Design of a Counter Using the Sequential Circuit Approach, FSM as an Arbiter Circuit, Analysis of Synchronous Sequential Circuits.
Self learning topics: Fundamentals of FSM- Mealy State Model.

Unit - IV 9 Hours

Digital System Design: Bus Structure, Simple Processor, Bit-counting circuit, Shift and add multiplier, Clock synchronization and timing.

Unit - V 9 Hours

FPGA Based Systems: Introduction, XILINX 3000 & 4000 Series FPGA.
SystemVerilog: Introduction to SystemVerilog, SystemVerilog Declaration Spaces, SystemVerilog Literal Values and Built-in Data Types.
Self learning topics: Comparative study of Verilog and SystemVerilog.

Text Books

1. Stephen Brown and D. Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design", McGraw-Hill, 3rd Edn. (onwards), 2009.
2. Nazeih M. Botros, "HDL Programming VHDL and Verilog", John Weily, 1st Edn. (onwards), 2008.
3. Stuart Sutherland, "SystemVerilog for Design", 2nd Edn. (onwards), Springer, 2006.
4. Charles H. Roth Jr., "Digital System Design using VHDL", Tata Mc.Graw-Hill, 2nd Edn. (onwards), 1998.
5. Samir Palnitkar, "VERILOG HDL, A Guide to Digital Design and Synthesis", Pearson Education 2nd Edn. (onwards), 2003.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Discuss the basic knowledge of HDL, its Syntax and programming.	L2
2. Demonstrate the ability to apply knowledge of HDL in modeling Combinational and Sequential circuits and write verilog code and its test bench to test the functionality of the design.	L3,L4
3. Use EDA tool for structural and behavioral modeling, simulation and functional verification of combinational and sequential logic using HDL in any problem identification, formulation and solution (Open ended examples).	L3, L4
4. Discuss the design flow of ASICs, FPGA based system and target a design to an FPGA Board.	L2
5. Recognize the importance of programming in SystemVerilog, its synthesis features, and ability to choose the Language for digital system design.	L2, L3

Program Outcome of this course (POs)	PO No.
1. **Fundamentals of Engineering**: Graduates shall be able to understand and apply the basic mathematical and scientific concepts in the field of Electronics and Communication Engineering.	1
2. **Design of Experiments**: Graduates shall possess the ability to design and conduct experiments, analyse and interpret data	2
3. **Modern tool Usage**: Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures.	5
4. **Research and Innovation**: Graduates shall have the ability to pursue research and provide innovative solutions.	11
5. **Self motivated Learning**: Graduates shall continue to upgrade the skills and possess the motivation for continuing education and professional growth.	12

Course delivery methods	Assessment methods
1. Black board	1. Assignments
2. Presentation	2. Quiz
3. Videos and MOOC	3. Case studies with real time examples.
4. Practical with EDA tools	4. Projects/ Literature survey

Scheme of Continuous Internal Evaluation (CIE):

Components	Average of best two IA tests out of three	**Average of assignments (Two) / activity**	**Quiz**	Class participation	Total Marks
Maximum Marks: 50	25	10	5	10	50
➢ Writing two IA tests is compulsory. ➢ **Minimum marks required to qualify for SEE :** 20					

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:** 40
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

LIC and Control Systems Lab

Course Code	ECL47	**Credits**	1.5
Course type	L1	**CIE Marks**	25 marks
Hours/week: L-T-P	0 – 0 – 3	**SEE Marks**	25 marks
Total Hours:	45	**SEE Duration**	3 Hours for 50 marks

Course Learning Objectives (CLOs)

1. To introduce the concept of designing and testing circuits like full wave precision rectifier, LPF, HPF, BPF and BEF.
2. To introduce the concept of designing and testing circuits like Zero-Crossing Detector, Schmitt Trigger, monostable and astable multivibrator.
3. To introduce the concept of designing and simulating RL, RC and RLC systems.
4. To introduce the concept of the stability of control system by building the Root Locus plot and Bode plot and suggest modifications in transfer function to improvise upon stability if system is found to be unstable.

List of experiments

1. Time response of RL, RC and RLC systems.
2. Root Locus of a system defined by an open loop transfer function.
3. Bode plot of a system defined by an open loop transfer function.
4. Design a lead/lag compensator.
5. Design and testing of Full-wave Precision Rectifier.
6. Design and testing of Second order active LPF and HPF.
7. Design and testing of Second order active BPF and BEF.
8. Design and testing of Zero-Crossing Detector and Schmitt Trigger.
9. Frequency synthesis using PLL.
10. Design and testing of Astable and Monostable Multivibrator using IC 555.
11. Design and testing of R-2R DAC and 4-bit SAR using op-amp.

The above experiments can be conducted using NI Multisim/ Hardware.

Text Books

1. Nagarath and Gopal, "Control Systems Engineering", New Age International Publications, 4th Edn. (onwards), 2005.
2. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th Edn. (onwards), Prentice Hall Inc., 2002.

Reference Books

1. Robert F. Coughlin and Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Prentice Hall Inc., 4th Edn. (onwards), 2000.
2. D. Roy Choudhury and Shail B. Jain, "Linear Integrated Circuits", New Age International, 2nd Edn. (onwards), 2003.
3. David A. Bell, "Operational Amplifiers and Linear ICs", Prentice Hall Inc., 2nd Edn. (onwards), 2004.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Design and test circuits like full wave precision rectifier, LPF, HPF, BPF and BEF.	L3, L4
2. Design and test circuits like Zero-Crossing Detector, Schmitt Trigger, monostable and astable multivibrator.	L3, L4
3. Determine time response specifications of RC, RL, RLC systems.	L3, L4
4 Determine the stability of control system by building the Root Locus plot and Bode plot and suggest modifications in transfer function to improvise upon stability if system is found to be unstable.	L3, L4

Program Outcome of this course (POs)	PO No.
1. **Fundamentals of Engineering**: Graduates shall be able to understand and apply the basic mathematical and scientific concepts in the field of Electronics and Communication Engineering.	1
2. **Design of Experiments:** Graduates shall possess the ability to design and conduct experiments, analyze and interpret data.	2
3. **Engineering Cognizance**: Graduates shall be able to stay abreast with recent developments in the field of Electronics and Communication Engineering.	4

Assessment methods

1. Internal Test
2. Quiz
3. Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab	Journal submission	Lab test	Total Marks
Maximum Marks: 25	10	10	5	25
➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE :** 13				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 50 marks of 3 hours duration**. It will be reduced to 25 marks for the calculation of SGPA and CGPA.**
2. **Minimum marks required in SEE to pass:** 20

Initial write up	2*10 = 20 marks	
Conduct of experiments	2*10 = 20 marks	50 marks
Viva- voce	10 marks	

Communication Lab

Course Code	ECL48	**Credits**	1.5
Course type	L2	**CIE Marks**	25 marks
Hours/week: L-T-P	0 – 0 – 3	**SEE Marks**	25 marks
Total Hours:	45	**SEE Duration**	3 Hours for 50 marks

Course Learning Objectives (CLOs)

1. To understand convolution, Fourier transform and Z transform.
2. To understand Amplitude and Angle modulation.
3. To study the effects of noise in communication systems.
4. To study the working of Radio and TV Systems.

List of experiments

1. Simulation of elementary signals and study of its properties.
2. Write a program to convolute two signals.
3. Write a program to find the Fourier transform of a signal.
4. Write a program to find the Z transform of a signal.
5. Solution of difference equation.
6. Study of effects of noise on signals.
7. Amplitude modulation and Demodulation.
8. Frequency modulation and Demodulation.
9. Balanced modulator to generate DSB SC
10. Pre emphasis and de emphasis.
11. Synchronous detector.
12. Spectrum analysis of AM and FM signals using spectrum analyzer.
13. Study of Radio and TV receiver.

The above experiments can be conducted using any of the following tools: MATLAB/ simulink / LabView or Equivalent / hardware.

Text Books

1. Simon Haykin, “An Introduction to Analog and Digital Communications”, John Wiley, 2nd Edn. (onwards), 2004.
2. B. P.Lathi, “Modern Digital and Analog Communication Systems”, Oxford, 3rd Edn. (onwards), 1998.
3. R.R.Gulati, “Monochrome and Colour Television”, New Age International Limited, 3rd Edn. (onwards), 2006.

Reference Books

1. Dennis Roddy and John Coolen, “Electronic Communication”, Prentice Hall of India, 4th Ed. (onwards), 1995.
2. Herbert Taub and Donald L Schilling, “Principles of Communication Systems”, Tata McGraw Hill, 3rd Edn. (onwards), 2008.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Analyze signals in time domain using convolution.	L4
2. Analyze signals in frequency domain using Fourier and Z transform.	L4
3. Express the basic concepts of analog modulation schemes.	L2
4. Determine the stability of control system by building the Root Locus plot and Evaluate analog modulated waveform in time /frequency domain and also find modulation index.	L5
5. Analyze different types of receivers.	L4

Program Outcome of this course (POs)	PO No.
1. **Fundamentals of Engineering:** Graduates shall be able to understand and apply the basic mathematical and scientific concepts in the field of Electronics and Communication Engineering.	1
2. **Design of Experiments:** Graduates shall possess the ability to design and conduct experiments, analyze and interpret data.	2
3. **Engineering Cognizance:** Graduates shall be able to stay abreast with recent developments in the field of Electronics and Communication Engineering.	4

Assessment methods

1. Internal Test
2. Quiz
3. Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab	Journal submission	Lab test	Total Marks
Maximum Marks: 25	10	10	5	25
➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE :** 13				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 50 marks of 3 hours duration**. It will be reduced to 25 marks for the calculation of SGPA and CGPA.**
2. **Minimum marks required in SEE to pass:** 20

Initial write up	2*10 = 20 marks	
Conduct of experiments	2*10 = 20 marks	50 marks
Viva- voce	10 marks	

Bridge Course Mathematics - II

Course Code	BCMAT41	**Credits**	0
Course type	BS	**CIE Marks**	50 marks
Hours/week: L-T-P	2 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	32	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives (CLOs)

1. Interpret the type of solutions of system of equations using the concept of rank of matrix.
2. Understand the geometry of Vectors and also the geometrical and physical interpretation of their derivatives.
3. Be proficient in Laplace Transforms and solve problems related them.
4. Get acquainted with Inverse Laplace Transform and solution of differential equations.

Pre-requisites:

1. Trigonometry.
2. Basic Differentiation.
3. Basic Integration.

Unit – I — 12 Hours

Linear Algebra: Rank of a matrix by elementary transformation, Solution of system of linear equations-Gauss Jordan method and Gauss-seidal method. Eigen values and Eigen vectors, Largest Eigen value by Rayleigh's Power method.

Unit – II — 10 Hours

Vectors: Vector Algebra: Vector addition, multiplication (Dot and Cross products) Scalar produt, Vector product and Triple product, Vector differentiation- Velocity, Acceleration of a Vector point function, Gradient, Curl and Divergence, Solenoidal and Irrotational fields, simple and direct problems.

Unit – III — 10 Hours

Laplace Transforms: Definition, Laplace transforms of elementary functions, derivatives and integrals
Inverse Laplace Transforms: Inverse transforms, applications of Laplace transform to differential equations.

Text Books

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edn and onwards., 2012.
2. H. K. Dass and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand, 3rd revised Edn. and onwards, 2014.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Interpret the type of solutions of System of equations using the concept of rank of matrix.	L3
2. Solve System of equations by direct and iterative methods	L3
3. Interpret the geometry of Vectors.	L3
4. Solve practical problems by vector approach.	L3
5. Evaluate Laplace Transforms and their properties and solve related problems.	L3
6. Use Laplace Transforms and Inverse Laplace Transforms in solving Differential Equations.	L3

	Program Outcome of this course (POs)	PO No.
1.	**Fundamentals of Engineering:** Graduates shall be able to understand and apply the basic mathematical and scientific concepts in the field of Electronics and Communication Engineering.	1
2.	**Modern tool Usage:** Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures.	5
3.	**Research and Innovation:** Graduates shall have the ability to pursue research and provide innovative solutions.	11

Scheme of Continuous Internal Evaluation (CIE):

Components	Maximum of two tests
Maximum marks	50

- Students have to score minimum 20 marks in CIE to appear for SEE

Scheme of Semester End Examination (SEE):

* Question paper contains 08 questions each carrying 20 marks.
* Students have to answer any FIVE full questions.
* SEE will be conducted for 100 marks of three hours duration. It will be reduced to 50 marks.
* Minimum marks required in SEE to pass: 40

Bloom's Taxonomy of Learning Objectives

Bloom's Taxonomy in its various forms represents the process of learning. It was developed in 1956 by Benjamin Bloom and modified during the 1990's by a new group of cognitive psychologists, led by Lorin Anderson (a former student of Bloom's) to make it relevant to the 21st century. The **revised taxonomy** given below emphasizes what a learner "Can Do".

Lower order thinking skills (LOTS)		
L1	Remembering	Retrieve relevant knowledge from memory.
L2	Understanding	Construct meaning from instructional material, including oral, written, and graphic communication.
L3	Applying	Carry out or use a procedure in a given situation – using learned knowledge.
Higher order thinking skills (HOTS)		
L4	Analyzing	Break down knowledge into its components and determine the relationships of the components to one another and then how they relate to an overall structure or task.
L5	Evaluating	Make judgments based on criteria and standards, using previously learned knowledge.
L6	Creating	Combining or reorganizing elements to form a coherent or functional whole or into a new pattern, structure or idea.