SYLLABUS FOR

Four-year Undergraduate Programme

Electronics Science

Under

New Education Policy (NEP)

2020

Committee for Courses and Studies (CCS) in Electronics UG

Department of Electronics and Communication Technology

Gauhati University, Guwahati-781014, Assam

Four-year Undergraduate Programme

Subject: Electronics Science

Existing Base Syllabus: UG CBCS Syllabus

Program Outcomes: The proposed B.Sc. (Honours) Electronic Science program will:

- Create basic know how and training to pursue higher study in the field of electronics and related discipline and provide them a dignified way of livelihood.
- Generate skilled manpower for industrial and research organizations in the field of electronics and related areas.
- Enable development of small- and large-scale entrepreneurship and management projects for startup programs and self-employment generation schemes.

Program Specific Outcomes: B.Sc. (Honours) Electronic Science Passed out Students will be

- Able to design and fabricate electronic systems that can be used for solving real life problems
- Capable of pursuing related professional assignments and confident enough to take up electronics as a career and contribute towards the well-being of the society.

Total No. of Credits: 60

- 1 Credit = 1 Theory period of one-hour duration
- 1 Credit = 1 Tutorial period of one-hour duration
- 1 Credit = 1 Practical period of three-hour duration

Marks Distribution for Paper(s) with Practical

End Semester Examination Marks	Theory	60
	Practical	20
Internal Examination Marks	Theory	10
	Practical	06
	Attendance	04
	Total Marks	100

Marks Distribution for Paper(s) without Practical

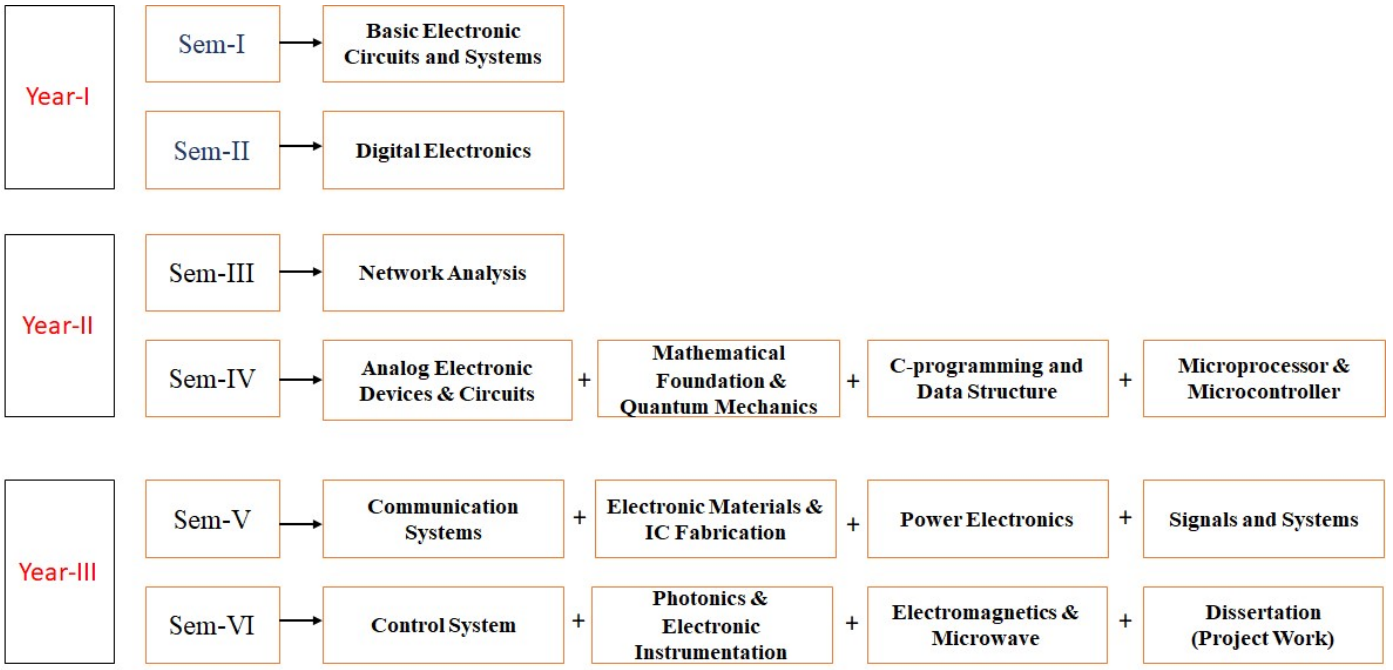
End Semester Examination Marks	Theory	80
Internal Examination Marks	Theory	10
	Assignment	06
	Attendance	04
	Total Marks	100

Core Papers for B.Sc. (Honours) Electronic Science under NEP

Serial No.	Type of Paper	Offered in Semester	Name of the paper	Credit
1	Core A-I	I	Basic Electronic Circuits and Systems	4 (3+1)
2	Core A-2	II	Digital Electronics	4 (3+1)

Major Papers for B.Sc. (Honours) Electronic Science under NEP

Serial No.	Type of Paper	Offered in Semester	Name of the paper	Credit
3	Major-1	III	Network Analysis	4 (3+1)
4	Major-2	IV	Analog Electronic Devices & Circuits	4 (3+1)
5	Major-3	IV	Mathematical Foundation & Quantum Mechanics	4
6	Major-4	IV	C-programming and Data Structure	4 (3+1)
7	Major-5	IV	Microprocessor & Microcontroller	4 (3+1)
8	Major-6	V	Communication Systems	4 (3+1)
9	Major-7	V	Electronic Materials & I.C Fabrication	4
10	Major-8	V	Power Electronics	4 (3+1)
11	Major-9	V	Signals and Systems	4 (3+1)
12	Major-10	VI	Control System	4 (3+1)
13	Major-11	VI	Photonics & Electronic Instrumentation	4
14	Major-12	VI	Electromagnetics & Microwave	4 (3+1)
15	Major-13	VI	Dissertation (Project Work)	4


Year-I
Sem-I
Basic Electronic Circuits and Systems
Sem-II
Digital Electronics
Year-II
Sem-III
Network Analysis
Sem-IV
Analog Electronic Devices & Circuits
+
Mathematical Foundation & Quantum Mechanics
+
C-programming and Data Structure
+
Microprocessor & Microcontroller
Year-III
Sem-V
Communication Systems
+
Electronic Materials & IC Fabrication
+
Power Electronics
+
Signals and Systems
Sem-VI
Control System
+
Photonics & Electronic Instrumentation
+
Electromagnetics & Microwave
+
Dissertation (Project Work)

Semester I

Core Paper A-1: Basic Electronic Circuits and Systems (100 Marks, Credit 3+1 =4)

Course Level: 100-199

Distribution of marks: (Internal:20, External: Theory:60 + Practical:20)

Internal Assessment: (Sessional:10+ Practical:06 + Attendence:04 = 20 Marks)
End Semester Examination: (Theory: 60, Practical: 20)

Course Objectives: To make the students able to apply concepts of basic electronic components and active electronic devices in solving engineering problems.

Learning Outcome: By the end of this course, students will be able to

- explain basics of electrical circuits and calculate node voltage and branch current of circuits with KVL and KCL
- knowledge about passive and active electronic components.
- Operation of basic electronic circuits.
- Application of electronics components in real life situations.

Unit-I: (No. of classes: 10 Lectures, Marks: 15)

Basic Circuit Concepts: Voltage and Current Sources, Resistors: Fixed and Variable resistors, Construction and Characteristics, Color coding of resistors, resistors in series and parallel. Inductor and Capacitor. DC Circuit Analysis: Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Node Analysis, Mesh Analysis.

Unit-II: (No. of classes: 15 Lectures, Marks: 20)

PN junction diode, Zener Diode and their I-V characteristics. Rectifiers- Half wave rectifier, Full wave rectifiers, circuit diagrams, working and waveforms, ripple factor and efficiency with capacitor filter. Zener diode as voltage regulator, and explanation for load and line regulation.

Unit-III: (No. of classes: 20 Lectures, Marks: 25)

Bipolar Junction Transistor CE and CB configurations, Regions of operation (active, cut off and saturation), Current gains α and β. Relations between α and β. dc load line and Q point. Transistor biasing and Stabilization circuits - Fixed Current Bias and Voltage Divider Bias. Unipolar Devices: JFET and MOSFET. Construction, working and I-V characteristics. OP-AMP and its applications as amplifier: adder and subtractor, Integrator & Differentiator. Basic concepts of PCB based circuit design.

Unit-IV: Practical (30 Hours; Marks:20)

List of Experiments:

Familiarization with a) Resistance in series, parallel and series – Parallel. b) Capacitors & Inductors in series & Parallel. c) Multimeter – Checking of components.

1. Measurement of Amplitude, Frequency & Phase difference of signals using CRO.
2. Verification of Kirchhoff's Laws.
3. Verification of voltage division and current division rules.
4. V-I characteristics of P-N Junction Diode
5. V-I characteristics of Zener Diode
6. Design of half-wave rectifier with filter
7. Design of full-wave rectifier with filter
8. CE/CB/CC characteristics of BJT
9. Design of an inverting and non-inverting amplifier using OP-AMP
10. Design of a Zener regulated power supply.

Suggested Books

1. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill (2004)
2. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGrawHill.(2005)
3. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)
4. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGrawHill(2005)
5. Alexander and M. Sadiku, Fundamentals of Electric Circuits, McGraw Hill (2008)

No. of Required Classes: 75

No. of Contact Classes: 70

No. of Non-Contact Classes: 05

Particulars of Course Designer (Name, Institution, email id):

Serial No	Name	Name of Institute	Email	Phone
1	Prof. Tulshi Bezboruah	Dept. of ECT, GU	zbt@gauhati.ac.in	9435109486
2	Dr. Hidam Kumarjit Singh	Dept. of ECT, GU	kumarjit_hidam@gauhati.ac.in	9706006963
3	Dr. Kumaresh Sarmah	Dept. of ECT, GU	kumaresh@gauhati.ac.in	9854660415
4	Dr. Ram Kishore Roy	Dept. of ECT, GU	ram_kishore@gauhati.ac.in	9854549598

5	Dr. Hirendra Das	Dept. of ECT, GU	hirendra@gauhati.ac.in	8638978914
6	Dr. Mitamoni Sarma	Dept. of Electronics Science, L.C.B College	sarmamitamoni2005@gmail.com	9864041335
7	Dr. Kakoli Kalita	Dept. of Electronics Science, L.C.B College	kalita.kakali@gmail.com	7896621580
8	Dr. Monalisha Goswami	Dept. of Electronics Science, L.C.B College	monalishagoswami7@gmail.com	8638441047

Semester II

Core Paper A-2: Digital Electronics (100 Marks, Credit 3+1 =4)

Course Level: 200-299

Distribution of marks: (Internal:20, External: Theory:60 + Practical:20)

Internal Assessment: (Sessional:10+ Practical:06 + Attendence:04 = 20 Marks)
End Semester Examination: (Theory: 60, Practical: 20)

Course Objectives: This course will enable the students to learn fundamentals of number system, digital logic circuits and hardware description language for digital system design.

Learning Outcome: By the end of this course, students will be able to

- Explain number system and operation of combinational and sequential logic circuits
- Design combinational and sequential logic circuits
- Design basic units of A/D and D/A converters

Unit I: (No. of classes:10 Lectures, Marks:15)

Number System and Codes: Decimal, Binary, Hexadecimal and Octal number systems, base conversions, Binary, octal and hexadecimal arithmetic, representation of signed and unsigned numbers, Binary Coded Decimal code. Logic Gates and Boolean algebra: Introduction to Boolean Algebra and Boolean operators, Truth Tables of OR, AND, NOT, Basic postulates and fundamental theorems of Boolean algebra, and Universal gates.

Unit- II: (No. of classes:15 Lectures, Marks:20)

Combinational Logic Analysis and Design: Standard representation of logic functions (SOP and POS), Karnaugh map, Encoder and Decoder, Multiplexers and Demultiplexers, binary Adder, binary subtractor, parallel adder/subtractor.

Unit-III: (No. of classes:20 Lectures, Marks:25)

Sequential logic design: Latches and Flip flops, S-R Flip flop, J-K Flip flop, T and D Type Flip flop, Clocked and edge triggered Flip flops, master slave flip flop, Registers, Counters (synchronous and asynchronous and modulo-N), Basic concepts of Semiconductor memories. Basic concepts of A/D and D/A converters and its types. Basics of 555 timers and its application in digital system design.

Unit-IV: Practical (30 Hours, Marks:20)

List of Experiments:

1. To verify and design AND, OR, NOT, XOR, NAND and NOR gates.
2. Realization of logic circuit from Boolean expressions.

3. Design a Half and Full Adder.
4. Design a Half and Full Subtractor.
5. Design a 4:1 Multiplexer using gates.
6. Design a 8:1 Multiplexer using IC 74151A.
7. Design a clocked S-R Flip Flop by using NAND/NOR gates.
8. Design a clocked J-K Flip Flop by using NAND/NOR gates.
9. Design a counter using D/T/JK Flip-Flop.
10. Design of frequency divider circuit by using J-K Flip Flop.

Suggested Books:

1. M. Morris Mano, Digital System Design, Pearson Education Asia, (Fourth Edition)
2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
3. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India (2000)
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)

No. of Required Classes: 75

No. of Contact Classes: 70

No. of Non-Contact Classes: 05

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		Science, L.C.B College		

Semester III

Major-1: Network Analysis (100 Marks, Credit 3+1 =4)

Course Level: 200-299

Distribution of marks: (Internal:20, External: Theory:60 + Practical:20)

Internal Assessment: (Sessional:10+ Practical:06 + Attendence:04 = 20 Marks)
End Semester Examination: (Theory: 60, Practical: 20)

Course Objectives: To make the students able to apply concepts of circuit theory and network theorems in solving engineering problems in DC and AC circuits

Learning Outcome: By the end of this course, students will be able to

- explain basics of electrical circuits and calculate node voltage and branch current of circuits with KVL and KCL
- simplify complex network to simpler equivalents by employing network theorems
- determine time response of circuits with Classical as well as Laplace transform methods
- analyze 2 port networks, transfer functions and frequency response of passive filters

Unit-I: (No. of Classes:10 Lectures, Marks:20)

Network analysis & review of network theorems: Elements of a Network, Network geometry;Graph and Tree of a network, Node and Mesh Analysis, Star and Delta networks, Star-Delta Conversion, Thevenin's theorem, Norton's theorem Superposition, Reciprocity and Maximum Power Transfer theorem.

Unit-II: (No. of Classes:20 Lectures, Marks:25)

Step function response of linear R-L, R-C, and R-L-C network. Network analysis using Laplace transformation: Laplace Transformation and inverse Laplace transformation, Application of Laplace transformation in R-L, R-C and R-L-C networks; Response to R-L, R-C and R-L-C networks to step & sinusoidal voltage, impedance and transfer function of a two port network.

Unit-III: (No. of Classes:15 Lectures, Marks:15)

Two port Networks**,** Network Filters: Passive Filters, High pass, Low pass, Band pass and band elimination filters, m-derived filters, Butterworth approximation; Chebychev and Bessel response; Filter Approximation and Frequency Transformation.

Unit-IV: Practical (30 Hours, Marks:20)

List of Experiments:

1. Verification of Thevenin's theorem.
2. Verification of Norton's theorem.

3. Verification of Superposition Theorem.
4. Verification of Reciprocity Theorem.
5. Verification of the Maximum Power Transfer Theorem.
6. Design and study of first & second order passive low pass RC filter circuits.
7. Design and study of first & second order passive high pass RC filter circuits.
8. Design and study of first & second order passive band pass RC filter circuits.
9. Design and study of first & second order passive band elimination RC filter circuits.

Suggested Books

1. Network analysis – G.K. Mittal, Khanna Publishers.
2. Network Theory and filters Design – V.K. Aatre, Wily Eastern Ltd.
3. Engineering Circuit Analysis – W.H. Hayt and J.E. Kemmerly, McGraw Hill.
4. Network Analysis – M.E. Van Valkenberg, Prentice Hall of India Pvt. Ltd,
5. Network Analysis – Ghosh, PHI

No. of Required Classes: 75

No. of Contact Classes: 70

No. of Non-Contact Classes: 05

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		Science, L.C.B College		

Semester IV

Major-2: Analog Electronic Devices & Circuits (100 Marks, Credit 3+1 =4)

Course Level: 200-299

Distribution of marks: (Internal:20, External: Theory:60 + Practical:20)

Internal Assessment: (Sessional:10+ Practical:06 + Attendence:04 = 20 Marks)
End Semester Examination: (Theory: 60, Practical: 20)

Course Objectives: This course will enable students to learn basic of semiconductor devices and design amplifier circuit by using transistor and operational amplifier.

Learning Outcome: By the end of this course, students will be able to

- Understand the working principles of BJT, JFET & MOSFET
- Design amplifier circuit by using transistors and Operational amplifiers
- Design Comparator, Adder, subtractors, basic filters Oscillator circuits by using Operational amplifiers

Unit-I: (No. of Classes:10 Lectures, Marks:15)

Physics of operation and structure of basic electronic devices such as PN-junction diodes, Formation of depletion region, barrier potential, junction capacitance, reverse recovery time, Schottky diodes; Bipolar Junction Transistor (BJT), Junction Field Effect Transistors (JFET) & Metal Oxide Field Effect Transistors (MOSFET); their I-V characteristic curves. Base width modulation and early effect in BJT and channel length modulation in JFET & MOSFET.

Unit-II: (No. of Classes:15 lectures, Marks:20)

Different methods of biasing BJT & MOSFET; Small signal models of BJT: Ebers–Moll model h-parameter & hybrid pi-model), small signal models of MOSFET (transconductance model). Small signal analysis of BJT & MOSFET amplifiers to find Z_{IN}, Z_{OUT}, A_V, A_I. Frequency response of amplifier. Multistage amplifiers and Power amplifiers: Class A, Class B, Class C & Class AB.

Unit-III: (No. of Classes:20 Lectures, Marks:25)

Basic Topologies of feedback amplifiers, Difference between positive and negative feedback, Electronic Oscillators, Working of Wein Bridge Oscillator, RC phase shift oscillator, Colpitts, Heartley & Crystal oscillators. Concept of differential amplifier, Operational amplifier (OP-Amp): Integrator, Differentiator, Active filters, Voltage to current converter, Current to voltage converter. Comparators: Basic comparator, Level detector, Voltage limiters, Schmitt Trigger. IC 555 as multivibrator circuit, Voltage controlled oscillator, Phase locked loops (PLL).

Unit-IV: Practical (30 Hours, Marks:20)

List of Experiments:

1. Design of DC voltage regulator by using Zener diode.
2. Design & study of single stage RC coupled BJT/MOSFET amplifier.
3. Design & study of voltage follower circuit by using BJT/MOSFET.
4. Design & study of Non-Inverting Op-Amp amplifier.
5. Design & study of inverting Op-Amp amplifier.
6. Design & study of comparator circuit with Op-Amp.
7. Design and study of adder circuit with Op-Amp.
8. Design & study of First order Butterworth active low pass filter with Op-Amp.
9. Design & study of First order Butterworth active high pass filter with Op-Amp.
10. Design & study of RC Phase shift oscillator with Op-Amp.
11. Design & study of Wein bridge oscillator with Op-Amp.

Suggested Books:

1. S. M. Sze, Semiconductor Devices: Physics and Technology, 2ndEdition, Wiley India edition (2002).
2. Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006).
3. Dennis Le Croissette, Transistors, Pearson Education (1989).
4. Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons (2001).
5. Kanaan Kano, Semiconductor Devices, Pearson Education (2004).
6. Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education (2006).
7. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004).

No. of Required Classes: 75

No. of Contact Classes: 70

No. of Non-Contact Classes: 05

Semester IV

Major-3: Mathematical Foundation & Quantum Mechanics (100 Marks, Credit 2+2 =4)

Course Level: 200-299

Distribution of marks: (Internal:20, External: Theory:80)

Internal Assessment: (Sessional:16 + Attendance: 04 = 20 Marks)
End Semester Examination: (Theory: 80)

Course Objectives: To impart basic mathematical concepts, problem solving skills and basic of Quantum Mechanics to the students.

Learning Outcome: By the end of this course, students will be able to

- Solve basic mathematical problems on vectors, matrics, differential equation & probability
- Apply the mathematical concepts in solving problems in electronic devices and circuits
- Understand the difference between classical & quantum physics
- Apply the quantum physics in understanding energy band theory and working of electronic devices.

Unit-I: (No. of Classes:15 Lectures, Marks:20)

Vector: Operations with vectors. Scalar and vector product; Vector Calculus. Scalar-valued functions, Vector function of a scalar variable: Vector differentiation & integration; gradient, divergence, and curl. Green, Gauss, Stokes Theorem. **Matrices**: Addition & multiplication of Matrices. Transpose of matrix, singular matrix, diagonal matrix, Symmetric and Skew – Symmetric matrices. Orthogonal matrix, solution of a system of linear equations by matrix method.

Unit-II: (No. of Classes:15 Lectures, Marks: 20)

Differential Equations: First Order Ordinary Differential Equations, Separable Ordinary Differential Equations, Exact Ordinary Differential Equations, Linear Ordinary Differential Equations. Second Order homogeneous and non-homogeneous Differential Equations. Complex Variables: Complex Variable, Complex Function, Continuity, Differentiability, Analyticity. Probability: continuous & random variables, Conditional probability, Bayes Theorem, Sum of random variables, the laws of large numbers, central limit theorem.

Unit-III: (No. of Classes:10 Lectures, Marks: 15)

Origin of quantum mechanics, wave particle duality, De Broglie's hypothesis, Wave packet, Heisenberg Uncertainty Principle, Pauli's exclusion principle, Wave function. General postulates of quantum mechanics, Time dependent & Time independent Schrödinger equation.

Unit-IV: (No. of Classes: 20 Lectures, Marks: 25)

Schrödinger equations of Free and confined electrons, potential well problems & Quantization of energy, Quantum tunneling, Kronig-penny model & energy band theory of solids, E-k band diagrams, density of states, basics of quantum dots, quantum wires and quantum wells.

Suggested Books:

1. Advanced Engineering Mathematics, Erwin Kryszig, Wiley India.
2. Fundamentals of Nanoelectronics, George W. Hanson, Pearson.
3. Introduction to Quantum Mechanics, D. J. Griffiths & D. F. Schroeter, Cambridge University.
4. R. K. Jain, and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House (2007).
5. C .R. Wylie and L. C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill (2004).

No. of Required Classes: 60

No. of Contact Classes: 60

No. of Non-Contact Classes: 00

Semester IV

Major-4: C-Programming & Data Structure (100 Marks, Credit 3+1 =4)

Course Level: 200-299

Distribution of marks: (Internal:20, External: Theory:60 + Practical:20)

Internal Assessment: (Sessional:10+ Practical:06 + Attendence:04 = 20 Marks)
End Semester Examination: (Theory: 60, Practical: 20)

Course Objectives: This course will enable the students to learn basic programming skills of C language and its application in solving science /engineering problems.

Learning Outcome: By the end of this course, students will be able to

- Explain syntax of C language, data types and various operators etc.
- Develop algorithm and flowchart of different problems and write corresponding program in C
- Write C programs for data structure related applications

Unit-I: (No. of Classes:10 Lectures, Marks: 15)

C Programming Language: Introduction of C, Character set, Tokens, keywords, identifier, constants, basic data types in C, Concept of variables. Structure of Cprogram Arithmetic operators, relational operators, logical operators, assignment operators, incrementand decrement operators, conditional operators, bit wise operators, expressions and evaluation of expressions, precedence of operators. Arrays-concepts, declaration, accessing elements, storing elements, two-dimensional and multi-dimensional arrays.

Unit-II: (No. of Classes:15 Lectures, Marks: 20)

Decision making, branching & looping: if-else, nested if- else, switch-case statement, definition of loop, categories of loops, for loop, while loop and do-while loop, break statement, continue statement. Functions: Defining a function, function argument and passing, returning values from functions. Structures: defining and declaring structure variables, accessing structure members, initialization and comparison of structure variables.

Unit-III: (No. of Classes:20 Lectures, Marks: 25)

Data Structures: Definition of stack, array implementation of stack, conversion of infix expression to prefix, postfix expressions, evaluation of postfix expression. Definition of Queue, Circular queues, Array implementation of queues. Linked List and its implementation, Link listimplementation of stack and queue, Circular and doubly linked list. Searching and sorting: Insertion sort, selection sort, bubble sort, merge sort, linear Search, binary search. Trees: Introduction to trees, Binary search tree, Insertion and searching in a BST.

Unit-IV: Practical (30 Hours, Marks:20)

List of Experiments:

1. Find factorial of a number using & without using recursion.
2. Calculate factorial of a given number.
3. Find all the roots of a quadratic equation Ax2 + Bx + C = 0 for non – zero coefficients A, B and C.
4. Find the sum & difference of two matrices of order MxN and PxQ.
5. Find the product of two matrices of order MxN and PxQ.
6. Find the transpose of given MxN matrix.
7. Calculate the subject wise and student wise totals and store them as a part of the structure.
8. Implement linear and circular linked lists using single and double pointers.
9. Create circular linked list having information about a college and perform Insertion at front, Deletion at end.
10. Create a Linear Queue using Linked List and implement different operations such as Insert, Delete, and Display the queue elements.

Suggested Books:

1. Yashavant Kanetkar, Let Us C, BPB Publications.
2. Programming in ANSI C, Balagurusamy, 2nd edition, TMH.
3. Byron S Gottfried, Programming with C, Schaum Series.
4. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, Prentice Hall.
5. Yashavant Kanetkar, Pointers in C, BPB Publications.
6. S. Sahni and E. Horowitz, "Data Structures", Galgotia Publications.
7. Tanenbaum: "Data Structures using C", Pearson/PHI.
8. Ellis Horowitz and Sartaz Sahani "Fundamentals of Computer Algorithms", ComputerScience Press.

No. of Required Classes: 75

No. of Contact Classes: 70

No. of Non-Contact Classes: 05

Semester IV

Major-5: Microprocessor and Microcontroller (100 Marks, Credit 3+1 =4)

Course Level: 300-399

Distribution of marks: (Internal:20, External: Theory:60 + Practical:20)

Internal Assessment: (Sessional:10+ Practical:06 + Attendence:04 = 20 Marks)
End Semester Examination: (Theory: 60, Practical: 20)

Course Objectives: This course will enable students to learn architecture and programming of microprocessors and microcontrollers.

Learning Outcome: By the end of this course, students will be able to

- Compare and contrast microprocessor and microcontroller
- Develop algorithm and write assembly language program for 8085 and 8051
- Interface basic I/O devices with microprocessor and microcontroller
- Design microcontroller-based circuits

Unit-1: (No. of Classes:15 Lectures, Marks:20)

Microcomputer Organization: Input/Output Devices. Data storage (idea of Semiconductor Memories). Classification of Computer memory. Introduction to embedded systems, architecture and classifications of embedded system, applications and purpose of embedded systems. 8085 and 8086 Microprocessors Architecture: Main features of 8085 and 8086. Block diagram and Pin-out diagram of 8085 and 8086. Data and address buses. Registers. ALU. Stack Pointer. Program counter.

Unit-2: (No. of Classes:15 Lectures, Marks:20)

8051 Microcontroller: Introduction and block diagram of 8051 Microcontroller, architecture of 8051, overview of 8051 families. 8051 Programming: 8051 addressing modes and accessing memory locations using various addressingmodes, assembly language instructions using each addressing mode. Introduction of I/O port programming pin out diagram of 8051 Microcontroller, I/O port programming in 8051. 8051 programming in C. Discussion on use of Keil and 8051. Assemblers for 8051 Programming.

Unit-3: (No. of Classes:15 Lectures, Marks:20)

8051 Timer/counter: Introduction to Timer/Counter of 8051, Programming of 8051 Timer/Counters. 8051 Serial Com: Introduction to serial communication of 8051, Baud rate programming, Programming 8051 for serial communication. 8051 Interrupts: Introduction to Interrupts of 8051, Programming of 8051 Interrupts. Interfacing of 8051: Interfacing of 8051 with ADC, and LCD. Discussion on use of Proteus software for simulation of 8051 based systems. Arduino: Introduction to Arduino, Pin diagram of Arduino and its Programming.

Unit-IV: Practical (30 Hours, Marks:20)

List of Experiments:

1. To find that the given numbers is prime/odd/even or not.

2. To find the factorial of a number.
3. Program to glow the first four LEDs then next four using TIMER application.
4. Program to rotate the contents of the accumulator first right and then left.
5. Program using Proteus software to toggle LED's connected across P1.2 pin.
6. Program to count frequency of the square signal applied to one of the counter pins of 8051.
7. Program to rotate the motor through a given angle in clockwise and anti-clockwise direction interface to 8051.
8. Program to display "HELLO" in the LCD interface to 8051.
9. Program to read the data of ADC interface with 8051.
10. Program to monitor temperature using LM35 sensor interface with 8051 and display the monitor temperature in LCD interface with 8051.

Suggested Books:

1. Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall.
2. Embedded Systems: Architecture, Programming & Design, Raj Kamal, 2008, Tata McGraw Hill.
3. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.
4. Microprocessor and Microcontrollers, N. Senthil Kumar, 2010, Oxford University Press.
5. 8051 microcontrollers, Satish Shah, 2010, Oxford University Press.
6. Embedded Systems: Design & applications, S.F. Barrett, 2008, Pearson Education India.
7. Introduction to embedded system, K.V. Shibu, 1st edition, 2009, McGraw Hill.

No. of Required Classes: 75

No. of Contact Classes: 70

No. of Non-Contact Classes: 05

Particulars of Course Designer (Name, Institution, email id):

Serial No	Name	Name of Institute	Email	Phone
1	Prof. Tulshi Bezboruah	Dept. of ECT, GU	zbt@gauhati.ac.in	9435109486
2	Dr. Hidam Kumarjit Singh	Dept. of ECT, GU	kumarjit_hidam@gauhati.ac.in	9706006963
3	Dr. Kumaresh Sarmah	Dept. of ECT, GU	kumaresh@gauhati.ac.in	9854660415
4	Dr. Ram Kishore Roy	Dept. of ECT, GU	ram_kishore@gauhati.ac.in	9854549598
5	Dr. Hirendra Das	Dept. of ECT, GU	hirendra@gauhati.ac.in	8638978914

6	Dr. Mitamoni Sarma	Dept. of Electronics Science, L.C.B College	sarmamitamoni2005@gmail.com	9864041335
7	Dr. Kakoli Kalita	Dept. of Electronics Science, L.C.B College	kalita.kakali@gmail.com	7896621580
8	Dr. Monalisha Goswami	Dept. of Electronics Science, L.C.B College	monalishagoswami7@gmail.com	8638441047

Semester V

Major-6: Communication Systems (100 Marks, Credit 3+1=4)

Course Level: 300-399

Distribution of marks: (Internal:20, External: Theory:60 + Practical:20)

Internal Assessment: (Sessional:10+ Practical:06 + Attendence:04 = 20 Marks)
End Semester Examination: (Theory: 60, Practical: 20)

Course objective: This course will enable students to understand fundamental of electroniccommunication process and communication systems.

Learning outcomes: By the end of this course, students will be able to

- Describe functional blocks of electronic communication system and sources of noise
- Compare and contrast amplitude, frequency and angle modulation systems
- Illustrate pulse modulation and digital communication techniques
- Design basic circuits for communication system

Unit-I: (No. of Classes:20 Lectures, Marks:25)

Analog communication: Block diagram of an electronic communication system, electromagnetic spectrum-band designations and applications, need for modulation, concept of channels, Concept of Noise, Amplitude Modulation: Amplitude Modulation, modulation index .Generation of AM, Amplitude Demodulation (diode detector), Concept of Double side band suppressed carrier, Single side band suppressed carrier, other forms of AM (Pilot Carrier Modulation, Vestigial Side Band modulation, Independent Side Band Modulation). Block diagram of AM Transmitter and Receiver, Angle modulation: Frequency and Phase modulation, modulation index andfrequency spectrum, equivalence between FM and PM, Generation of FM (direct and indirect methods), FM detector (PLL). Block diagram of FM Transmitter and Receiver Comparison between AM, FM and PM.

Unit-II: (No. of Classes:20 Lectures, Marks: 25)

Digital Communication: Block diagram of digital transmission and reception, Channel capacity, Sampling theorem, PAM, PDM, PPM modulation and detection techniques, Multiplexing, TDM and FDM. Pulse Code Modulation: Need for digital transmission, Quantizing, Uniform and Non- uniform Quantization, Quantization Noise, Companding,Coding, Decoding, Regeneration., Information capacity, Bit Rate, Baud Rate and M-array coding. Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK); TDMA, FDMA, CDMA concepts, comparison of TDMA and FDMA.

Unit-III: (No. of Classes: 5 Lectures, Marks:10)

Cellular Communication: Concept of cellular mobile communication – cell and cell splitting, frequency bands used in cellular communication, absolute RF channel numbers (ARFCN), frequency reuse, roaming and hand off, CDMA technology, simplified block diagram of cellular phone handset, Comparative studyof GSM and CDMA, 2G, 3G, 4G and 5G concepts.

Unit-IV: Practical (30 Hours, Marks: 20)

List of Experiments:

1. Study of Amplitude Modulation
2. Study of Amplitude Demodulation
3. Study of Frequency Modulation
4. Study of Frequency Demodulation
5. Study of Pulse Amplitude Modulation
6. Study of Pulse Width Modulation
7. Study of Pulse Position Modulation
8. Study of Pulse Code Modulation
9. Study of Amplitude Shift Keying
10. Study of Phase Shift Keying,
11. Study of Frequency Shift Keying.

Suggested Books:

1. Electronic communication systems- Kennedy, 3rd edition, McGraw international publications.
2. Principles of Electronic communication systems – Frenzel, 3rd edition, McGraw Hill.
3. Communication Systems, S. Haykin, Wiley India (2006).
4. Advanced electronic communications systems – Tomasi, 6th edition, PHI.
5. Communication Systems, S. Haykin, Wiley India (2006).

No. of Required Classes: 75

No. of Contact Classes: 70

No. of Non-Contact Classes: 05

Semester V

Major-7: Electronic Materials & I.C Fabrication (100 Marks, Credit 2+2=4)

Course Level: 300-399

Distribution of marks: (Internal:20, External: Theory:60 + Practical:20)

Internal Assessment: (Sessional:16 + Attendence:04 = 20 Marks)
End Semester Examination: (Theory: 80)

Course objective: This course will enable students to understand fundamental of electronic materials and Integrated circuit fabrication technology.

Learning Outcome: By the end of this course, students will be able to learn

- Knowledge of the different types and its operations of electronic materials.
- Different types of electronic materials and its applications
- Basics of I.C process technology and its applications

Unit-I: (No. of Classes:15 Lectures, Marks:20)

Classification of solids - insulator, semiconductor and conductors; Intrinsic and extrinsic Semiconductors, Compound semiconductors – binary, ternary and quaternary types and their properties; carrier generation and recombination, carrier scattering in semiconductors. Electronic properties and application of semiconductor – semiconductor junction, metal – semiconductor junction, metal – insulator junction, insulator – semiconductor junction in electronic device fabrication.

Unit-II: (No. of Classes:15 Lectures, Marks:20)

Conductors: Free electron theory of metals, Electrical conductivity and resistance, Boltzmann transport equation, thermionic emission and photoelectric effect, contact potential between metals, metallic alloys. Dielectric polarizations - electronic, ionic, orientation types, dielectric breakdown; dielectric loss and relaxation time. Theory of ferromagnetic, anti-ferromagnetic, ferromagnetic, paramagnetic and diamagnetic materials; their properties and application in electrical and electronic engineering. Physics of superconductors and superconducting materials.

Unit-III: (No. of Classes:15 Lectures, Marks:20)

Introduction to I.C s: Definition, scale of integration, types-monolithic, hybrid, thick & thin films; capacitance & resistance formation in ICs, idea of IC packages; Thin Film: Basic definitions- thin and thick films, properties of thin films, thin film deposition methods- PVD, CVD, Epitaxy theory of nucleation and growth in thin films; VPE, LPE, MOCVD, MBE techniques.

Unit-IV: (No. of Classes:15 Lectures, Marks:20)

Introduction to silicon planar technology. Fabrication of Diode, BJT, FET & MOSFET in ICs; Bulk semiconductor growth: zone refining technique Czochralski growth, vertical and horizontal Bridgman technique. Wafer preparation, oxidation, diffusion, ion implantation, metallization, pattern definition, encapsulation, lithography: advanced processing technique.

Suggested Books:

1. Solid State Physics - A J Dekker, McMillan Publisher, India.
2. An Introduction to Solid State Physics - Charles Kittel, Wiley Publishers.
3. Semiconductor Devices – Physics and Technology - S.M.Sze, Wiley.
4. Electrical properties of materials - L.Solymar and D Walsh.
5. CMOS VLSI design – Circuits and System perpectives, Neil H.E.Weste, David H., A.Banerjee, Pearson Ed.
6. Microelectronics – B. Razavi.

No. of Required Classes: 60

No. of Contact Classes: 60

No. of Non-Contact Classes: 00

Semester V

Major-8: Power Electronics (100 Marks, Credit 3+1=4)

Course Level: 300-399

Distribution of marks: (Internal:20, External: Theory:60 + Practical:20)

Internal Assessment: (Sessional:10+ Practical:06 + Attendence:04 = 20 Marks)
End Semester Examination: (Theory: 60, Practical: 20)

Course Objectives: This course will be able to make students understand fundamentals of power electronic devices and systems.

Learning Outcome: By the end of this course, students will be able to

- Explain characteristics of power electronics devices
- Design power converter circuits, choppers etc.
- Analyze performance of basic electrical machines related to power electronics

Unit- I: (No. of Classes:10 Lectures, Marks: 15)

Power Devices: Need for semiconductor power devices, Power diodes, Power transistor, Power MOSFETs, Introduction to family of thyristors. Silicon Controlled Rectifier (SCR): structure, I-V characteristics, Turn-On and Turn-Off characteristics, ratings, Factors affecting the characteristics/ratings of SCR, Gate-triggering circuits, Triggering and protection circuit: Thyristor firing, circuit- using transistor, UJT, PUT etc. thyristor gate protection circuit, di/dt and dv/dt protection for thyristors, Snubber circuit.

Unit- II: (No. of Classes:15 Lectures, Marks: 20)

Diac and Triac: Basic structure, working and V-I characteristic, Diac as a triggering device for a Triac. Insulated Gate Bipolar Transistors, AC voltage control using SCR and Triac as a switch. Application of SCR: SCR as a static switch, phase-controlled rectification, single phase half wave, fullwave -Semi converter and full converter, simple LC and cascaded LC filters, Power factor improvement.

Unit-III: (No. of Classes:20 Lectures, Marks: 25)

Power Inverters: Need for commutating circuits and their various types, Principle of operation, voltage driven inverters, current driven inverters, Choppers: basic chopper circuit and principles, choppers(Type A-D), step-down chopper, step-up chopper, Jones Chopper, Morgan's chopper, AC power supply systems: CVTs, Stabilizers, tap changers, UPS types (on-lineand off line) etc; Special application DC power supplies: CVCC, voltage mode and current mode SMPS, DC Motors, Basic understanding of field and armature, Principle of operation, EMF equation, Back EMF, Factors controlling motor speed, Thyristor based speed control of dc motors, AC motor.

Unit-IV: Practical (30 hours, Marks: 20)

List of Experiments:

1. Study of I-V characteristics of DIAC.

2. Study of I-V characteristics of a TRIAC.
3. Study of I-V characteristics of a SCR.
4. SCR as a half wave and full wave rectifiers with R and RL loads.
5. DC motor control using SCR.
6. DC motor control using TRIAC.
7. AC voltage controller using TRIAC with UJT triggering.
8. Study of parallel and bridge inverter.
9. Design of snubber circuit.
10. VI Characteristic of MOSFET and IGBT (Both).

Suggested Books:

1. Power Electronics – Rashid, PHI
2. Power Electronics- P.C. Sen, TMH Ltd.
3. Thyristor engineering- M.S. Berdi, Khanna publications.
4. Thyristors and their applications - N.Rammurthy

No. of Required Classes: 75

No. of Contact Classes: 70

No. of Non-Contact Classes: 05

Semester V

Major-9: Signals and Systems (100 Marks, Credit 3+1=4)

Course Level: 300-399

Distribution of marks: (Internal:20, External: Theory:60 + Practical:20)

Internal Assessment: (Sessional:10+ Practical:06 + Attendence:04 = 20 Marks)
End Semester Examination: (Theory: 60, Practical: 20)

Course Objectives: This course will make the students able to understand fundamentals of signals and systems needed to take up advanced courses in digital signal processing.

Learning Outcome: By the end of this course, students will be able to

- Explain different types of signals
- Determine Laplace transform, and Fourier series and transform of different signals
- Describe and analyze properties of LTI systems and their responses

Unit-I: (No. of Classes:15 Lectures, Marks:20)

Signals and Systems: Continuous-Time and Discrete-Time signals, Classification of Signals, Continuous-Time and Discrete-Time Systems, Classification of Systems, Basic System Properties. Laplace Transform: Laplace Transform, Inverse Laplace Transform, Properties of the LaplaceTransform, Laplace Transform of important signals, examples of RC, RL, RLC circuits as systems.

Unit-II: (No. of Classes:15 Lectures, Marks:20)

Fourier Analysis of Periodic and Aperiodic Continuous-Time Signals: Trigonometric Fourier Series, Exponential Form of Fourier Series, Parseval's Identity for Fourier Series, Power Spectrum of a Periodic Signal, Fourier Transform, Properties of Fourier Transform, Fourier Transform of important signals. Discrete Signals: Discrete Fourier Series, Discrete-Time Fourier Transform, Fast Fourier Transform. z-Transform & Inverse-z Transform, Properties of z-transform and evaluation of the Inverse z-Transform.

Unit-III: (No. of Classes:15 Lectures, Marks:20)

Linear Time -Invariant Systems (LTI): Discrete time LTI systems, Continuous time LTI systems, the Convolution integral. Linear and Circular Convolution. Properties of LTI systems, LTI systems with and without memory, Differential and Difference equation formulation, Block diagram representation of first order systems. Digital Filters: Basic concept of Digital Filters, Magnitude and phase responses, Finite Impulse Response Filters (FIR), Infinite Impulse Response Filters (IIR). Design Technique for FIR and IIR Filters.

Unit-IV: Practical (30 hours, Marks: 20)

List of Experiments:

1. Generation of Continuous-time Signals.
2. Generation of discrete -time Signals.
3. Time shifting and time scaling of continuous-time and discrete-time signals.
4. Convolution of two given x(t) and h(t) continuous time Signals.
5. Fourier series representation of continuous time signals.

6. Fourier transform of continuous time signals.
7. Laplace transform of continuous time signals.
8. Generate and plot sequences over an interval.
9. For a given sequence x[n], write program to find its z-transform X[z].
10. Convolution of two given x(n) and h(n) discrete time sequences.
11. Design of digital filters.

Suggested Books:

1. V. Oppenheim, A. S. Wilsky and S. H. Nawab, Signals and Systems, Pearson Education (2007).
2. S. Haykin and B. V. Veen, Signal and Systems, John Wiley & Sons (2004).
3. C. Alexander and M. Sadiku, Fundamentals of Electric Circuits, McGraw Hill (2008).
4. H. P. Hsu, Signals and Systems, Tata McGraw Hill (2007).
5. S. T. Karris, Signal and Systems: with MATLAB Computing and Simulink Modelling, Orchard Publications (2008).
6. W. Y. Young, Signals and Systems with MATLAB, Springer (2009).
7. M. Roberts, Fundamentals of Signals and Systems, Tata McGraw Hill (2007).

No. of Required Classes: 75

No. of Contact Classes: 70

No. of Non-Contact Classes: 05

Particulars of Course Designer (Name, Institution, email id):

Serial No	Name	Name of Institute	Email	Phone
1	Prof. Tulshi Bezboruah	Dept. of ECT, GU	zbt@gauhati.ac.in	9435109486
2	Dr. Hidam Kumarjit Singh	Dept. of ECT, GU	kumarjit_hidam@gauhati.ac.in	9706006963
3	Dr. Kumaresh Sarmah	Dept. of ECT, GU	kumaresh@gauhati.ac.in	9854660415
4	Dr. Ram Kishore Roy	Dept. of ECT, GU	ram_kishore@gauhati.ac.in	9854549598
5	Dr. Hirendra Das	Dept. of ECT, GU	hirendra@gauhati.ac.in	8638978914
6	Dr. Mitamoni Sarma	Dept. of Electronics Science, L.C.B College	sarmamitamoni2005@gmail.com	9864041335
7	Dr. Kakoli Kalita	Dept. of Electronics Science,	kalita.kakali@gmail.com	7896621580

		L.C.B College		
8	Dr. Monalisha Goswami	Dept. of Electronics Science, L.C.B College	monalishagoswami7@gmail.com	8638441047

Semester VI

Major-10: Control Systems (100 Marks, Credit 3+1 =4)

Course Level: 300-399

Distribution of marks: (Internal:20, External: Theory:60 + Practical:20)

Internal Assessment: (Sessional:10+ Practical:06 + Attendence:04 = 20 Marks)
End Semester Examination: (Theory: 60, Practical: 20)

Course Objectives: This course will be providing fundamentals of closed loop control system and their stability criterion and time domain responses.

Learning Outcome: By the end of this course, students will be able to

- Explain difference between open loop and closed loop control systems, signal flow graph and reduction techniques
- analyze time domain and frequency domain response of control systems and their stability
- Illustrate state variable analysis of control system

Unit- I: (No. of Classes: 15 lectures, Marks: 20)

Introduction to Control Systems: Open loop and Closed loop control systems, Mathematical modelingof physical systems (Electrical, Mechanical and Thermal), Derivation of transfer function, Armature controlled and field-controlled DC servomotors, AC servomotors, block diagram representation & signal flow graph, Reduction Technique, Mason's Gain Formula. Effect of feedback on control systems.

Unit- II: (No. of Classes: 15 lectures, Marks: 20)

Time Domain Analysis: Time domain performance criteria, transient response of first and order systems, steady state errors and static error constants. Concept ofStability: Asymptotic stability and conditional stability, Routh – Hurwitz criterion, relative stability analysis, Root Locus plots and their applications. Frequency Domain Analysis: Correlation between time and frequency response, Polar plots, frequency domain specifications, Bode Plots, gain and phase margins,Nyquist stability criterion, relative stability using Nyquist criterion.

Unit III: (No. of Classes: 15 lectures, Marks: 20)

State Space Analysis: Definitions of state, state variables, state space, representation of systems, Solution of time invariant, homogeneous state equation, state transition matrix and its properties. Controllers and Compensation Techniques: Response with P, PI and PID Controllers, Concept of compensation, Lag, Lead and Lag-Lead networks.

Unit-IV: Practical (30 Hours, Marks: 20)

List of experiments:

1. To study characteristics of: (a). Synchro transmitter receiver, (b). Synchro as an error detector.
2. To study position control of DC motor.
3. To study speed control of DC motor.
4. To find characteristics of AC servo motor.
5. To study time response of type 0, 1 and 2 systems.
6. To study frequency response of first and second order systems.

7. To study time response characteristics of a second order system.
8. To study effect of damping factor on performance of second order system.
9. To study frequency response of Lead and Lag networks.
10. Study of P, PI and PIDcontroller.

Suggested Books:

1. J. Nagrath & M. Gopal, Control System Engineering, New Age International, 2000
2. K. Ogata, Modern Control Engineering, PHI 2002
3. B. C. Kuo, "Automatic control system", Prentice Hall of India, 2000

No. of Required Classes: 75

No. of Contact Classes: 70

No. of Non-Contact Classes: 05

Semester VI

Major-11: Photonics and Electronics Instrumentations (100 Marks, Credit 4)

Course Level: 300-399

Distribution of marks: (Internal:20, External: Theory:80)

Internal Assessment: (Sessional:16 + Attendence:04 = 20 Marks)
End Semester Examination: (Theory: 80)

Course Objectives: This paper will make students able to understand the fundamentals of light propagation in different media, interference, diffraction, and principles of other optoelectronic devices and optical communication. This course will also enable the students to learn fundamental concepts of test and measuring electronic instrumentation.

Learning Outcome: By the end of this course, students will be able to

- Explain propagation of light wave in different media
- Illustrate interference and diffraction of light waves
- Demonstrate use of LED, LASER, photodetectors and optical fiber
- explain accuracy, precision, sources of error in measurement
- demonstrate the working principle and application of basic test and measuring instruments
- describe fundamentals of sensors and transducers

Unit-I: (No. of Classes:15 Lectures, Marks: 20)

Light as an Electromagnetic Wave: Plane waves in homogeneous media, concept of spherical waves. Reflection and transmission at an interface, total internal reflection, Brewster's Law. Interaction of electromagnetic waves with dielectrics: origin of refractive index, dispersion. Interference: Superposition of waves of same frequency, Concept of coherence, Interference by division of wave front, Young's double slit, Newton's rings; Michelson interferometer. Holography.

Unit-II: (No. of Classes:15 Lectures, Marks: 20)

Light Emitting Diodes: Construction, materials and operation. Lasers: Interaction of radiation and matter, Einstein coefficients, Condition for amplification, laser cavity, threshold for laser oscillation, line shape function. Diode laser. Photodetectors: Photomultiplier tube, Charge Coupled Device. Phototransistors and Photodiodes (p-i-n, avalanche), quantum efficiency and responsivity. LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays, applications, advantages over LED displays. Optical Fiber: Step index and graded index optical fiber, Single mode and multimode fiber, total internal reflection of light in fiber, power losses in fiber & dispersion.

Unit-III: (No. of Classes:15 Lectures, Marks: 20)

Electronic instruments & their characteristics, a generalized instrumentation scheme, classification of instrumentation error & their statistical behaviour; Basic instrumentation circuits- voltmeter, digital voltmeter, Q-meter, watt meter; DC ammeters; ohmmeter, multimeter-analog & digital. CRO and Function generator. Block diagram of CRO & DSO. Frequency domain measurements-Distortion analyzer, Wave and spectrum analyzer spectrum analyzer.

Unit-IV: (No. of Classes:15 Lectures, Marks:20)

Transducers & Sensors: Definition, types-active & passive, analog & digital; active-thermocouple & piezoelectric transducers, passive- potentiometric devices, thermistors, RTD, LVDT; displacement & temperature sensors; Digital measurement techniques, Time and frequency measurements, Interface of instruments with computer, Virtual Instruments. Digital transducers; Sensors- conventional and bio-sensors, Fiber optic sensors.

Suggested Books:

1. Fundamentals of photonics – B.E.A. Saleh, M.C.Teich, Wiley Interscience.
2. Principles of Nanophotonics – E.R. Pike, R.G.W. Brown, Taylor and Francis.
3. Photonic crystal – J.D.Joannopolous et. al, Princeton Univ. Press.
4. Integrated Optics – K. Iga, Y. Kokobun, Taylor and Francis.
5. Instrumentation, Measurement and Feedback- B.E. Jones, Tata McGraw Hill.
6. Electronics Measurements and Instrumentation- B.E. Oliver and J.M. Cage, McGraw Hill.
7. Electrical & Electronic Measurements- Sawhnay….,Dhanpat Rai Publications.
8. Process Control- Johnson, Pearson Education.

No. of Required Classes: 75

No. of Contact Classes: 70

No. of Non-Contact Classes: 05

Semester VI

Major-12: Electromagnetics & Microwave (100 Marks, Credit 3+1=4)

Course Level: 300-399

Distribution of marks: (Internal:20, External: Theory:60 + Practical:20)

Internal Assessment: (Sessional:10 + practical: 06+Attendence:04 = 20 Marks)
End Semester Examination: (Theory: 60, Practical: 20)

Course Objectives: This paper will make students able to understand fundamentals of Electromagnetics that will be needed for courses on Applied electromagnetics and microwaves.

Learning Outcome: By the end of this course, students will be able to

- Solve electrostatic and magneto static problems based on Poisson's and Laplace equations
- Describe physical significance of Maxwell's equations and applications in plane wavepropagation and guidance
- Discuss the basics of microwave devices and its characteristics.

Unit-I: (No. of Classes:15 Lectures, Marks:20)

Electrostatic Fields: Coulomb's Law and Electric Field, Field due to Discrete and Continuous Charge Distributions, Electric Flux Density, Gauss's Law and Applications, Divergence Theorem and Maxwell's First Equation. Electric Potential, Potential due to a Charge and Charge distribution, Electric dipole. Electric Fields in Conductors, Current and Current Density, Continuity of Current, Metallic Conductor Properties and Boundary Conditions, Method of Images. Dielectric materials, Polarization, Dielectric Constant, Isotropic and Anisotropic dielectrics, Boundary conditions, Capacitance and Capacitors. Electrostatic Energy and Forces.

Unit-II: (No. of Classes:15 Lectures, Marks:20)

Magnetostatics: Biot Savert's law and Applications, Magnetic dipole, Ampere's Circuital Law, Divergence and Stoke's Theorem, Maxwell's Equation, Magnetic Flux and Magnetic Flux Density, Scalar and Vector Magnetic Potentials. Magnetization in Materials and Permeability, Anisotropic materials, Magnetic Boundary Conditions, Inductors and Inductances, Magnetic Energy, Magnetic Circuits. Inductances and Inductors, Magnetic Energy, Forces and Torques. Time-Varying Fields and Maxwell's Equations: Faraday's Law of Electromagnetic Induction, Maxwell's Equations in differential and integral form and Constitutive Relations.

Unit-III: (No. of Classes:15 Lectures, Marks:20)

Microwave transmission line: Basic equations, Solution of transmission line equation, Reflection and transmission co-efficient, Voltage Standing wave ratio (VSWR), Line impedance and admittance, Transmission and Reflection co-efficient. Microwave wave guide: Introduction to microwave wave guides, Solution of wave equation in Rectangular and Circular Wave guides, attenuation in waveguides, propagation modes, TE, TM, and TEM, Wave guide impedance. Basics of microwave antenna and its applications.

Unit-IV: Practical (30 hours, Marks: 20)

List of Experiments:

1. Understanding and Plotting Vectors.
2. Transformation of vectors into various coordinate systems.
3. 2D and 3D Graphical plotting with change of view and rotation.
4. Representation of the Gradient of a scalar field, Divergence and Curl of Vector Fields.
5. Plots of Electric field and Electric Potential due to charge distributions.
6. Plots of Magnetic Flux Density due to current carrying wire.
7. Programs and Contour Plots to illustrate Method of Images
8. Solutions of Poisson and Laplace Equations – contour plots of charge and potential
9. Introduction to Computational Electromagnetics: Simple Boundary Value Problems by Finite Difference/Finite Element Methods**.**

Suggested Books:

1. D. C. Cheng, Field and Wave Electromagnetics, Pearson Education (2001).
2. J. A. Edminster, Electromagnetics, Schaum Series, Tata McGraw Hill (2006).
3. N. Narayan Rao, Elements of Engineering Electromagnetics, Pearson Education (2006).
4. Introduction to Electrodynamics, D.J. Griffiths, Pearson Education (2012).
5. Electromagnetic Wave and Radiating System, Jordan and Balmain, Prentice Hall (1979).
6. Foundations for Microwave Engineering, Collin, McGraw Hill.
7. Microwave Engineering by Annapurna Das & Sisir K. Das, Tata McGraw Hill.
8. Radio Frequency & Microwave Electronics by Matthew M. Radmanesh, Pearson Education Asia.

No. of Required Classes: 75

No. of Contact Classes: 70

No. of Non-Contact Classes: 05

Semester VI

Major-12: Dissertation (Project Work) (100 Marks & Credits:04)

Course Level: 300-399

Distribution of marks: 100 Marks

End Semester Examination: (Practical: 80 Marks)
Internal Assessment: (Practical:16 + Attendence:04 = 20 Marks)

Course Objectives: This elective course is meant for students to acquire advanced practical skill / knowledge by doing experimental investigation on a given topic of Electronics with an advisory support from a teacher / faculty member. It involves application of knowledge in solving / analyzing /exploring a real-life situation / difficult problem. This paper is meant to be introduction of research component/concept in Under-Graduate Courses.

Learning Outcome: By the end of this course, students will be able to

- demonstrate creativity and critical thinking ability
- gain confidence in application of theoretical knowledge to practical aspects
- Design circuits, PCB and solder components on the PCB

Process of doing Project/Dissertation

- Familiarity with research ethics & plagiarism
- Choosing a research area
- Literature review
- Problem formulation and definition of the project work
- Generation of innovative ideas for solving the solving
- Modular design, implementation and testing
- System integration & testing
- PCB design and soldering of the tested circuit
- Report writing
- Correction by Supervisor Printing & Hard binding

Other information

- ✓ There may be maximum number of 2 students in a project group.
- ✓ Supervisor is supposed to assign different parts of the project works to each student of the group so that each student remains actively engaged.
- ✓ Weekly interaction between students and respective Supervisor should be done to ensure progress of the work.
- ✓ Supervisor should help the students in a way to generate and unleash creativity and critical thinking ability of students.
- ✓ Group discussion should be encouraged by supervisors about their research/design problems

Particulars of Course Designer (Name, Institution, email id):

Serial No	Name	Name of Institute	Email	Phone
1	Prof. Tulshi Bezboruah	Dept. of ECT, GU	zbt@gauhati.ac.in	9435109486
2	Dr. Hidam Kumarjit Singh	Dept. of ECT, GU	kumarjit_hidam@gauhati.ac.in	9706006963

3	Dr. Kumaresh Sarmah	Dept. of ECT, GU	kumaresh@gauhati.ac.in	9854660415
4	Dr. Ram Kishore Roy	Dept. of ECT, GU	ram_kishore@gauhati.ac.in	9854549598
5	Dr. Hirendra Das	Dept. of ECT, GU	hirendra@gauhati.ac.in	8638978914
6	Dr. Mitamoni Sarma	Dept. of Electronics Science, L.C.B College	sarmamitamoni2005@gmail.com	9864041335
7	Dr. Kakoli Kalita	Dept. of Electronics Science, L.C.B College	kalita.kakali@gmail.com	7896621580
8	Dr. Monalisha Goswami	Dept. of Electronics Science, L.C.B College	monalishagoswami7@gmail.com	8638441047