THE BHAWANIPUR EDUCATION SOCIETY COLLEGE

A MINORITY RUN COLLEGE. AFFILIATED TO UNIVERSITY OF CALCUTTA
RECOGNISED UNDER SECTION 2(F) & 12 (B) OF THE UGC ACT, 1956

Program Outcome (PO) of Graduation Degree Course of

Electronics Honours (CBCS)

	Program Outcome	Description
PO1	**Subject Knowledge**	Knowing the fundamentals of the different areas of discussion within the subject which will enable the students to consider applying the theoretical principles in practical situations that they are likely to find themselves in as professionals after having completed the course.
	Method of Measurement:	**Assessment (Internal & Final)**
PO2	**Communication Skills**	Encouraging the students to apply the principles learned in their own fields, both professional and personal, thus, honing their communication skills and leading them towards becoming better communicators serving the society and nation as expected in the ICT age.
	Method of Measurement:	**Regular Communication Activity Internal Assessment**
PO3	**Technical Skill Development**	Knowing and developing the technical skills expected from the students in the professional arena, thus, becoming successful professional communicators/educators after finishing the program.
	Method of Measurement:	**Assessment (Internal & Final)**
PO4	**Personality Development**	Imparting personality development skills to the students that are likely to help them in their professional and personal lives, thus making them responsible and sincere citizens.
	Method of Measurement:	**Regular Personality Development Internal Assessment**

PO5	**Higher Study Foundation**	Encouraging the students to pursue higher studies in the subject and enhance their knowledge on the same.
	Method of Measurement:	**Regular Teacher-Student Interactive Sessions**
PO6	**Research Orientation and Aptitude**	Encouraging the students to pursue research avenues related to the subject either in the academic or in the professional sphere that may lead to a vibrant knowledge economy.
	Method of Measurement:	**Regular Teacher-Student Interactive Sessions**
PO7	**Spirit of Team Work**	Encouraging the students to coordinate with one another in a team environment and perform well as a team rather than trying to excel individually at the cost of group performance efficiency.
	Method of Measurement:	**Group Activity Assignments Assessment**

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Program Specific Outcomes (PSO) of Graduation Degree Course of

Electronics Honours (CBCS)

1. The students learn the fundamentals of Electronics theory and practice.

2. The students will appreciate the theoretical foundations related to different paradigms such as electromagnetism, quantum mechanics, communication and semiconductor devices etc.

3. The students learn the practicalities and techniques of professional communication practices such as in colleges, symposiums, conferences and seminars and in international platforms.

4. The students become effective and ethical practitioners contributing to social and national development.

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Course Outcomes (COs) of Graduation Degree Course of

Electronics Honours (CBCS) for the session, 2018-2021

Semester – I	
Paper	**Course Outcomes**
ELT-A-CC-1-01-TH: Basic Circuit Theory and Network Analysis	1.1.1 Students learn how to apply physical laws and theorems to real circuits.
Basic circuit concepts, basic circuit analysis, DC and AC circuit analysis, network theorems, two port networks and network graph theorems.	
ELT-A-CC-1-01-P: Basic Circuit Theory and Network Analysis Lab	1.1.2 Critical analysis of circuit parameters in view of scientific principles, so that it leads to synthesis of elements (passive and active) for innovative outcomes.
Familiarization with: (a) Resistance in Series, Parallel and Series-Parallel; (b) Capacitors and Inductors in Series and Parallel; (c) Multimeter - Checking of Components; (d) Voltage Sources in Series, Parallel and Series-Parallel; (e) Voltage and Current Dividers. 2. Measurement of Amplitude, Frequency and Phase Difference using CRO. 3. Verification of Kirchoff's Law. 4. Verification of Norton's Theorem. 5. Verification of Thevenin's Theorem. 6. Verification of Superposition Theorem. 7. Verification of the Maximum Power Transfer Theorem. 8. RC Circuits: Time Constant, Differentiator, Integrator. 9. Designing of a Low Pass RC Filter and study of its Frequency Response. 10. Designing of a High Pass RC Filter and study of its Frequency Response. 11. Study of the Frequency Response of a Series LCR Circuit and determination of its (a) Resonant Frequency; (b) Impedance at Resonance; (c) Quality Factor Q; (d) Band Width.	
ELT-A-CC-1-02-TH: Mathematics Foundation for Electronics	1.2.1 Students understand and appreciate the various mathematical methods to solve pertinent problems.
Ordinary differential equations, series solution to ODEs and special functions, matrices, sequences and series, complex variables and functions, Laplace's transforms.	
ELT-A-CC-1-02-P: Mathematics Foundation for Electronics Lab	

Mathematics Foundation for Electronics using simulation software like MATLAB/Scilab Solution of First Order Differential Equations. 2. Solution of Second Order Homogeneous Differential Equations. 3. Solution of Second Order Non-Homogeneous Differential Equations. 4. Convergence of a given Series. 5. Divergence of a given Series. 6. Solution of Linear System of Equations using Gauss Elimination Method. 7. Solution of Linear System of Equations using Gauss-Seidel Method. 8. Solution of Linear System of Equations using L-U Decomposition Method.	1.2.2 Students understand and appreciate the various mathematical methods to solve pertinent problems.
Semester - II	
ELT-A-CC-2-03-TH: Applied Physics	
Physics of crystalline solids, Quantum mechanics, mechanical properties of solids, thermal properties, electrical properties, magnetic properties and statistical mechanics.	2.1.1 Knowledge and understanding of various physical processes governing the structures of materials.
ELT-A-CC-2-03-P: Applied Physics Lab	
To Measure the Resistivity of a Si Crystal with Temperature by Four-Probe Method from Room Temperature to 200 OC). 2. To Determine the Value of Boltzmann Constant by Studying Forward Characteristics of Diode. 3. To Determine the Value of Planck's Constant by using LEDs of Different Wavelengths. 4. Simulation Studies: (a) Find Lowest Energy Eigenvalues for 1-D Schrodinger Equation. (b) Plotting Tunneling Probability as a Function of Barrier Width. (c) Plot Energy Band-Diagram corresponding to Different Potential Profile.	2.1.2 Analysis of various material properties to appreciate the nature of things.
ELT-A-CC-2-04-TH: C Programming and Data Structures	
C Programming language, decision making, branching and looping, structures, introduction to C++, data structures, searching and sorting	2.2.1 Programming language is studied to facilitate the computation and simulation abilities of the students.
ELT-A-CC-2-04-P: C Programming and Data Structures Lab	

1.Generate the Fibonacci Series up to the given Limit N and also Print the Number of Elements in the Series. 2. Find Minimum and Maximum of N Numbers. 3. Find the GCD of Two Integer Numbers. 4. Calculate Factorial of a given Number. 5. Find all the Roots of a Quadratic Equation Ax2 + Bx + C = 0 for Non -Zero Coefficients A, B and C. Else Report Error. 6. Calculate the Value of sin(x) and cos(x) using the Series. Also Print sin(x) and cos(x) Value using Library Function. 7. Generate and Print Prime Numbers up to an Integer N. 8. Sort given N Numbers in Ascending Order. 9. Find the Sum and Difference of Two Matrices of Order M×N and P×Q. 10. Find the Product of Two Matrices of Order M×N and P×Q. 11. Find the Transpose of given M×N Matrix. 12. Find the Sum of Principle and Secondary Diagonal Elements of the given M×N Matrix. 13. Calculate the Subject wise and Student wise Totals and Store them as a Part of the Structure. 14. Implement Linear and Circular Linked Lists using Single and Double Pointers. 15. Create a Stack and Perform Pop, Push, Traverse Operations on the Stack using Linear Linked List. 16. Create Circular Linked List having Information about a College and Perform Insertion at Front, Deletion at End. 17. Create a Linear Queue using Linked List and Implement Different Operations such as Insert, Delete, and Display the Queue Elements. 18. Implement Polynomial Addition and Subtraction using Linked Lists. 19. Implement Sparse Matrices using Arrays and Linked Lists. 20. Create a Binary Tree to Perform Tree Traversals (Preorder, Post-order, In-order) using the Concept of Recursion. 21. Implement Binary Search Tree using Linked Lists. Compare its Time Complexity over that of Linear Search. 22. Implement Insertion Sort, Merge Sort, Bubble Sort, and Selection Sort.	2.2.2 Programming language is implemented to facilitate the computation and simulation abilities of the students.
Semester - III	
ELT-A-CC-3-05-TH: Semiconductor Devices	

Semiconductor basics, carrier transport phenomena, physics of junctions, semiconductor-semiconductor homo-junction, PN junction diode, application of junction properties, bipolar junction transistors, field effect transistors, JFETs, MOSFETs, power devices.	3.1.1 Students learn the fundamentals of semiconductor devices which are the basic components of electronic equipment.
ELT-A-CC-3-05-P: Semiconductor Devices Lab	
Study of the I-V Characteristics of PN Junction Diode and Zener Diode. 2. Study of the I-V Characteristics of the Common Emitter Configuration of BJT and obtain r_i, r_o, β. 3. Study of the I-V Characteristics of the Common Base Configuration of BJT and obtain r_i, r_o, α. 4. Study of the I-V Characteristics of the SCR. 5. Study of the I-V Characteristics of the Diac. 6. Study of the I-V Characteristics of the Triac. Page∠11 7. Study of the I-V Characteristics of JFET/MOSFET. 8. Study of Characteristics of Solar Cell. 9. Study of Hall Effect.	3.1.2 Students appreciate the operational principles of devices to understand their usefulness and viability.
ELT-A-CC-3-06-TH: Electronic Circuits	
Diode circuits, BJT circuits, feedback amplifiers, MOSFET circuits, power amplifiers, single tuned amplifiers.	3.2.1 Students learn about the electronic circuits and their functionalities involving device operation.
ELT-A-CC-3-06-P: Electronic Circuits Lab	
Hardware and Circuit Simulation Software 1. Study of the Half-Wave Rectifier and Full-Wave (Center-tap and Bridge) Rectifier. 2. Study of Power Supply using C Filter and Zener Diode. 3. Designing and Testing of 5V/9V DC Regulated Power Supply using Two Transistors and find it's Load Regulation. 4. Study of Clipping and Clamping Circuits. 5. Study of Fixed Bias, Voltage Divider Bias and Collector-to-Base Bias Feedback Configuration for Transistors. 6. Designing of a Single Stage CE Amplifier. 7. Study of the Colpitt's Oscillator. 8. Study of the Phase Shift Oscillator 9. Study of the Frequency Response of Common Source FET Amplifier.	3.2.2 Students design the electronic circuits and their functionalities involving device operation. Experimentation facilitates the students to better understand the working principles of the devices.
ELT-A-CC-3-07-TH: Electromagnetics	

Vector analysis, Poisson's and Laplace equations, electrostatics, magnetostatics, time-varying fields and Maxwell's equations, EM wavepropagation	3.3.1 The basic electromagnetism is appreciated by the students.
ELT-A-CC-3-07-P: Electromagnetics Lab	
Scilab/MATLAB/Any Other Similar Free Software 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 Distributions. 9. Introduction to Computational Electromagnetics - Simple Boundary Value Problems by Finite Difference/Finite Element Methods.	3.3.2 These help to better visualize the electric and magnetic fields and their mathematical manipulations which are the central concepts in EM theory.
SEC-1: Group-A (SEC-A) Option-1 (SEC-1-A-1) **ELT-A-SEC-3-A-1-HT: Design and Fabrication of Printed Circuit Boards**	3.4.1 Hands-on training in circuits development and practical troubleshooting.
PCB Fundamentals, Schematic and Layout Design, Technology of PCB and PCB Technology	
SEC-1: Group-A (SEC-A) Option-2 (SEC-1-A-2) **ELT-A-SEC-3-A-2-HT: Circuit Modeling using PSPICE**	3.5.1 Circuit development using coding knowledge is developed.
Introduction, basic analysis and circuit modeling	
Semester – IV	
Core Course (CC) - 8 Theory **ELT-A-CC-4-08-TH: Operational Amplifiers and Applications**	
Basic Operational Amplifier, Op-Amp Parameters, Op-Amp Circuits and Applications, Comparators, Signal Generators, Timers Circuits, Fixed and	4.1.1 Understanding the fundamental analog electronic devices which make up larger electronic equipment.

Variable IC Regulators, Signal Conditioning Circuits	
Core Course (CC) - 8 Practical **ELT-A-CC-4-08-P: Operational Amplifiers and Applications Lab**	
Hardware and Circuit Simulation Software 1. Study of Op-Amp Characteristics: CMRR and Slew Rate. 2. Designing of an Amplifier of given Gain for an Inverting and Non-Inverting Configuration using an Op- Amp. 3. Designing of Analog Adder and Subtractor Circuit. 4. Designing of an Integrator using Op-Amp for a given Specification and Study its Frequency Response. 5. Designing of a Differentiator using Op-Amp for a given Specification and Study its Frequency Response. 6. Designing of a First Order Low-Pass Filter using Op-Amp. 7. Designing of a First Order High-Pass Filter using Op-Amp. 8. Designing of a RC Phase Shift Oscillator using Op-Amp. 9. Designing of a Wien Bridge Oscillator using Op-Amp. 10. Study of IC 555 as Astable Multivibrator. 11. Study of IC 555 as Monostable Multivibrator. 12. Designing of Fixed Voltage Power Supply using IC Regulators using 78 Series and 79 Series.	4.1.2 The related practical knowledge to understand electronic circuits
Core Course (CC) - 9 Theory **ELT-A-CC-4-09-TH: Digital Electronics and VHDL**	
Number System and Codes, Logic Gates and Boolean Algebra, Digital Logic Families, Combinational Logic Analysis and Design, Sequential Logic Design, Programmable Logic Devices, Memory, Introduction to VHDL, Behavioral Modeling, Sequential Processing, Data Types	4.2.1 Understanding the fundamental digital electronic devices which make up larger electronic equipment.
Core Course (CC) - 9 Practical **ELT-A-CC-4-9-P: Digital Electronics and VHDL Lab**	
Hardware 1. To Verify and Design AND, OR, NOT and XOR Gates using NAND Gates. 2. To Convert a Boolean Expression into Logic Gate Circuit and Assemble it using Logic Gate IC's. 3. Design Half and Full Adder. 4. Design Half and Full Subtractor. 5. Design Seven Segment Display Driver. 6. Design 4 × 1 Multiplexer using Gates. 7. To Build Flip-Flop Circuits (RS, Clocked RS,	4.2.2 The related practical knowledge to understand electronic circuits.

D-type) using Elementary Gates. 8. Design Counters (Ring, Ripple, Johnson and Mod-N) using D/T/JK Flip-Flop. 9. Design Shift Register and Study Serial and Parallel Shifting of Data. **Experiments in VHDL (Circuit Simulation)** 1. Write Code to Realize Basic and Derived Logic Gates. 2. Half Adder and Full Adder using Basic and Derived Gates. 3. Half Subtractor and Full Subtractor using Basic and Derived Gates. 4. Clocked D FF, T FF and JK FF (with Reset Inputs). 5. Multiplexer (4×1, 8×1) and Demultiplexer using Logic Gates. 6. Decoder (2×4, 3×8), Encoders and Priority Encoders. 7. Design and Simulation of 4-Bit Adder. 8. Code Converters (Binary to Gray and Vice Versa). 9. 2-bit Magnitude Comparator. 10. 3-bit Ripple Counter.	
Core Course (CC) – 10 Theory **ELT-A-CC-4-10-TH: Signals and Systems** Signals and Systems, Linear Time Invariant Systems (LTI), Fourier Series, Fourier Transform, Z-Transform,	4.3.1 Understanding signals and how systems are built based on different signals.
Core Course (CC) - 10 Practical **ELT-A-CC-4-10-P: Signals and Systems Lab** **Scilab/MATLAB/Any Other Mathematical Simulation Software** 1. Generation of Continuous Time Signals. 2. Generation of Discrete Time Signals. 3. Time Shifting and Time Scaling of Signals. 4. Convolution of Signals. 5. Solution of Difference Equations. 6. Fourier Series Representation of Continuous Time Signals. 7. Fourier Transform of Continuous Time Signals. 8. Laplace Transform of Continuous Time Signals. 9. Introduction to Xcos/Similar Function and Calculation of Output of Systems Represented by Block Diagrams.	4.3.2 Mathematical coding to understand signals.
SEC-2: Group-B (SEC-B) Option-1 (SEC-2-B-1) **ELT-A-SEC-4-B-1-TH: Internet and Java Programming** Internet, Data types, Arrays, Operators, Flow Control, Exception Handling, File Handling	4.4.1 Internet and Java Programming
SEC-2: Group-B (SEC-B) Option-2 (SEC-2-B-2) **ELT-A-SEC-4-B-2-TH: Programming with Matlab/Scilab** MATLAB Basics, Matrices and Vectors, Computer Programming, MATLAB Programming, Numerical Simulations	4.5.1 Programming with Matlab/Scilab

Semester – V

Core Course - 11 Theory **ELT-A-CC-5-11-TH: Electronic Instrumentation**	
Qualities of Measurement, Basic Measurement Instruments, Connectors and Probes, Measurement of Resistance and Impedance, A-D and D-A Conversion, Oscilloscope, Signal Generators, Transducers and Sensors	5.1.1 Understanding electrical and electronic measurement.
Core Course - 11 Practical **ELT-A-CC-5-11-P: Electronic Instrumentation Lab**	
1. Design of Multi Range Ammeter and Voltmeter using Galvanometer. 2. Measurement of Resistance by Wheatstone Bridge and Measurement of Bridge Sensitivity. 3. Measurement of Capacitance by de' Sautys. 4. Measure of Low Resistance by Kelvin's Double Bridge. 5. Design and Implementation of Instrumentation Amplifier using 741 Op-Amp. 6. To Determine the Characteristics of Resistance Transducer - Strain Gauge (Measurement of Strain using Half and Full Bridge). 7. To Determine the Characteristics of LVDT. 8. To Determine the Characteristics of Thermistors and RTD. 9. Measurement of Temperature by Thermocouples and Study of Transducers like AD590 (Two Terminal Temperature Sensor), PT-100, J- type, K-type. 10. To Study the Characteristics of LDR, Photodiode, and Phototransistor: (a) Variable Illumination; (b) Linear Displacement. 11. Design and Implementation of Temperature Controller.	5.1.2 Related practical
Core Course - 12 Theory **ELT-A-CC-5-12-TH: Microprocessors and Microcontrollers**	
Introduction to Microprocessors, Microprocessor 8085,8085 Instructions, Introduction to Microcontrollers, PIC16F887 Microcontroller, Interfacing to PIC16F887	5.2.1 Microprocessors and Microcontrollers
Core Course - 12 Practical **ELT-A-CC-5-12-P: Microprocessors and Microcontrollers Lab**	
Assembly Language Programming: 1. Program to Transfer a Block of Data. 2. Program for Multibyte Addition. 3. Program for Multibyte Subtraction. 4. Program to Multiply Two 8 Bit Numbers. 5. Program to Divide a 16 Bit Number by 8 Bit Number. 6. Program to Search a given Number in a given	5.2.2 Practicals on coding in microprocessors and microcontrollers

List. 7. Program to Generate Terms of Fibonacci Series. 8. Program to find Minimum and Maximum among N Numbers. 9. Program to find the Square Root of an Integer. 10. Program to find GCD of Two Numbers. 11. Program to Sort Numbers in Ascending/Descending Order. 12. Program to Verify the Truth Table of Logic Gates. **PIC Microcontroller Programming:** 1. LED Blinking with a Delay of 1 second. 2. Solid State Relay Interface. 3. Interfacing of LCD (2×16). 4. Interfacing of Stepper Motor and Rotating Stepper Motor by N Steps Clockwise/Anticlockwise with Speed Control. 5. To Test all the Gates of a given IC74XX is Good or Bad. 6. Generate Sine, Square, Sawtooth, Triangular and Staircase Waveform using DAC Interface. 7. Display of 4-Digit Decimal Number using the Multiplexed 7-Segment Display Interface. 8. Analog to Digital Conversion using Internal ADC and Display the Result on LCD. 9. Implementation of DC Voltmeter (0-5V) using Internal ADC and LCD. 10. Digital to Analog Conversion using PWM (Pulse Delayto be Implemented using Timers). 11. Speed Control of DC Motor using PWM (Pulse Delay to be Implemented using Timers). 12. Interfacing of Matrix Keyboard (4×4). 13. Serial Communication between Microcontroller and PC.	
Discipline Specific Electives (DSE) - 1 **DSE-1: Group-A (DSE-A) Option-1 (DSE-1-A-1)** **Theory ELT-A-DSE-5-A-1-TH: Numerical Techniques**	
Numerical Methods, Solution of Transcendental and Polynomial Equations, Interpolation and Polynomial Approximations, Curve Fitting, Numerical Integration, Numerical Differentiation, Numerical methods for first order differential equations, Numerical Methods in Linear Algebra, Matrix Eigenvalue	5.3.1 Understanding various mathematical tools to solve complex equations.
DSE-1: Group-A (DSE-A) Option-1 (DSE-1-A-1) **Practical ELT-A-DSE-5-A-1-P: Numerical Techniques Lab**	
C Language/Scilab/MatLab/Any Other Mathematical Simulation Software 1. Program to Implement Bisection Method. 2. Program to Implement Secant Method. 3. Program to Implement Regula Falsi Method. 4. Program to Implement Newton Raphson	5.3.2 Coding practical to implement such tools

Method. 5. Program to Implement Trapezoidal Rule. 6. Program to Implement Simpson's Rule. 7. Program to Implement Runge Kutta Method. 8. Program to Implement Euler-Cauchy Method. 9. Program toImplement Gauss-Jordon Method. 10. Program to Implement Gauss-Seidel Iteration. 11. Program to Implement Newton Forward/Backward Interpolation. 12. Program to Implement Lagrange's Interpolation.	
DSE-1: Group-A (DSE-A) Option-2 (DSE-1-A-2) Theory ELT-A-DSE-5-A-2-TH: Control Systems	
Introduction to Control Systems, Time Domain Analysis, Concept of Stability, Frequency Domain Analysis, State Space Analysis, Controllers and Compensation Techniques	5.4.1 Understanding electronic control systems
DSE-1: Group-A (DSE-A) Option-2 (DSE-1-A-2) Practical ELT-A-DSE-5-A-2-P: Control Systems Lab	
Implementation using Hardware and Scilab/MATLAB/Any Other Circuit Simulation Software 1. To Study Characteristics of: (a) Synchro Transmitter Receiver; (b) Synchro as 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 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 PID Controller.	5.4.2 Related practical
Discipline Specific Electives (DSE) - 2 **DSE-2: Group-B (DSE-B) Option-1 (DSE-2-B-1) Theory** **ELT-A-DSE-5-B-1-TH: Semiconductor Fabrication and Characterization**	
Introduction of Semiconductor Process Technology, Epitaxy Deposition, Characterization, Oxidation, Diffusion, Lithographic Processes, Etching,, Metallization, Process Integration	5.5.1 Understanding chip fabrication processes
DSE-2: Group-B (DSE-B) Option-1 (DSE-2-B-1) Practical **ELT-A-DSE-5-B-1-P: Semiconductor Fabrication**	

and Characterization Lab	
1. To Measure the Resistivity of Semiconductor Crystal with Temperature by Four-Probe Method. 2. To Determine the Type (n or p) and Mobility of Semiconductor Material using Hall-Effect. 3. Oxidation Process Simulation. 4. Diffusion Process Simulation. 5. Process Integration Simulation. 6. Fabrication of Thin Film using Spin Coating System. 7. Crystallographic Analysis and Particle Size Determination by X-Ray Diffraction (XRD) (of the given XRD Spectra). Introduction to JCPDS Card. 8. Determination of Optical Bandgap through Transmission Spectra from Published Literature.	5.5.2 Related practical
DSE-2: Group-B (DSE-B) Option-2 (DSE-2-B-2) Theory ELT-A-DSE-5-B-2-TH: Power Electronics	
Power Devices, Silicon Controlled Rectifier (SCR), Diac and Triac, Insulated Gate Bipolar Transistors (IGBT), Application of SCR, Power MOSFETs, Power Inverters, Choppers, Regulators and Converters, Electromechanical Machines	5.6.1 Understanding power electronics
DSE-2: Group-B (DSE-B) Option-2 (DSE-B-2) Practical ELT-A-DSE-5-B-2-P: Power Electronics Lab	
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. V-I Characteristic of MOSFET and IGBT (Both). 11. Study of Chopper Circuits.	5.6.2 Related practical
Semester – VI	
Core Course - 13 Theory ELT-A-CC-6-13-TH: Communication Electronics	
Electronic Communication, Amplitude Modulation, Angle Modulation, Pulse Analog Modulation, Pulse Code Modulation, Digital	6.1.1 Understanding communication electronics

Carrier Modulation Techniques	
Core Course - 13 Practical **ELT-A-CC-6-13-P: Communication Electronics Lab**	
Hardware and Circuit Simulation Software 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 CodeModulation. 9. Study of Amplitude ShiftKeying. 10. Study of Phase Shift Keying. 11. Study of Frequency Shift Keying.	6.1.2 Related practical
Core Course - 14 Theory **ELT-A-CC-6-14-TH: Photonics**	
Light as Electromagnetic Wave, Interference, Diffraction, Polarization, Light Emitting Diodes, Lasers, Photodetectors, LCD Displays, Guided Waves and Optical Fiber	6.2.1 Understanding light propagation through guided/unguided media
Core Course - 14 Practical **ELT-A-CC-6-14-P: Photonics Lab**	
1. To Determine Wavelength of Sodium Light using Newton's Rings. 2. To Determine the Resolving Power and Dispersive Power of DiffractionGrating. 3. Diffraction Experiments using a Laser. 4. To Determine the Specific Rotation of Scan Sugar using Polarimeter. 5. To Determine Characteristics of LEDs and Photo-Detector. 6. To Measure the Numerical Aperture of an Optical Fiber.	6.2.2 Related practical
Discipline Specific Electives (DSE) - 3 **DSE-3: Group-A (DSE-A) Option-1 (DSE-3-A-1)** **Theory ELT-A-DSE-6-A-1-TH: Basic VLSI Design**	
Metal Oxide Semiconductor (MOS), MOS Inverter, Combinational MOS Logic Design, Memory Design	6.3.1 Understanding basic VLSI
DSE-3: Group-A (DSE-A): Option-1 (DSE-3-A-1) Practical ELT-A-DSE-6-A-1-P: Basic VLSI Design Lab	
Implementation using Hardware and/or any Circuit Simulation Software	6.3.2 Related practical

1. To Plot the Output Characteristics and Transfer Characteristics of n-Channel and p-Channel MOSFET. 2. To Design and Plot the Static (VTC) and Dynamic Characteristics of Digital CMOS Inverter To Design and Plot the Output Characteristics of 3-Inverter Ring Oscillator. 3. To Design and Plot the Dynamic Characteristics of 2-Input NAND, NOR, XOR and XNOR Logic Gates using CMOS Technology. 4. To Design and Plot the Characteristics of a 4×1 Digital Multiplexer using Pass Transistor Logic. 5. To Design and Plot the Characteristics of a Positive and Negative Latch Based on Multiplexers. 6. To Design and Plot the Characteristics of a Master-Slave Positive and Negative Edge Triggered registers Based on Multiplexers.	
DSE-3: Group-A (DSE-A) Option-2 (DSE-3-A-2) Theory ELT-A-DSE-6-A-2-TH: Digital Signal Processing	
Discrete Time Systems, Network Synthesis, Discrete Fourier Transform, Digital Filters	6.4.1 Understanding digital signal processing (DSP)
DSE-3: Group-A (DSE-A) Option-2 (DSE-3-A-2) Practical ELT-A-DSE-6-A-2-P: Digital Signal Processing Lab	
Implementation using Scilab/MATLAB/Any Other Mathematical Simulation Software 1. Generation of Unit Sample Sequence, Unit Step, Ramp Function, Discrete Time Sequence, Real Sinusoidal Sequence. 2. Generate and Plot Sequences over an Interval. 3. Given x[n], Write Program to Find X[z]. 4. Fourier Transform, Discrete Fourier Transform and Fast Fourier Transform. 5. Design of a Butterworth Analog Filter for Low Pass and High Pass. 6. Design of Digital Filters.	6.4.2 Related practical
Discipline Specific Electives (DSE) - 4 **DSE-4: Group-B (DSE-B) Option-1 (DSE-4-B-1) Theory ELT-A-DSE-6-B-1-TH: Biomedical Instrumentation**	
Biomedical Signals and Physiological Transducers, Patient Monitoring Systems and Audiometers, Modern Imaging Systems, Patients Safety and Computer Applications in Biomedical Field, Physiotherapy	6.5.1 Understanding biomedical instrumentation
DSE-4: Group-B (DSE-B) Option-1 (DSE-4-B-1) Practical ELT-A-DSE-6-B-1-P: Biomedical	

Instrumentation Lab	
1. Characterization of Bio Potential Amplifier for ECG Signals. 2. Study on ECG Simulator. 3. Measurement of Heart Sound using Electronic Stethoscope. Study on ECG Heart Rate Monitor/Simulator. 4. Study of Pulse Rate Monitor with Alarm System. 5. Determination Pulmonary Function using Spirometer (using Mechanical System). 6. Measurement of Respiration Rate using Thermistor/Other Electrodes. 7. Study of Respiration Rate Monitor/Apnea Monitor. 8. Study on Ultrasound Transducers Based on Medical System. 9. Study of Pacemaker. 10. Measurement of Pulse Rate using Photoelectric Transducer and Pulse Counting for known Period.	6.5.2 Related practical
DSE-4: Group-B (DSE-B) Option-2 (DSE-4-B-2) Theory **ELT-A-DSE-6-B-2-TH: Transmission Lines, Antenna and Microwave Devices**	
Transmission Lines, Guided Waves and Waveguides, Antenna Fundamentals and Parameters, Antenna as Transmitter/Receiver, Types of Antennas (Qualitative Study Only), Propagation of Radio Waves, Microwave Devices (Qualitative Study Only)	6.6.1 Understanding electronics sender/receiver systems
DSE-4: Group-B (DSE-B) Option-2 (DSE-4-B-2) Practical **ELT-A-DSE-6-B-2-P: Transmission Lines, Antenna and Microwave Devices Lab**	
Implementation with Hardware and/or SciLab/MATLAB/Any Other Mathematical Simulation Software 1. Program to Determine the Phasor of Forward Propagating Field. 2. Program to Determine the Instantaneous Field of Plane Wave. 3. Program to Find the Phase Constant, Phase Velocity, Electric Field Intensity and Intrinsic Ratio. 4. Program to Find Skin Depth, Loss Tangent and Phase Velocity. 5. Program to Determine the Total Voltage as Function of Time and Position in Loss Less Transmission Line. 6. Program to Find the Characteristic Impedance, Phase Constant and Phase Velocity. 7. Program to Find the Output Power and	6.6.2 Related practical

Attenuation Coefficient. 8. Program to Find the Power Dissipated in Lossless Transmission Line. 9. Program to Find the Total Loss in Lossy Lines. 10. Program to Find the Load Impedance of Slotted Line. 11. Program to Find the Input Impedance of Transmission Line Terminated with Pure CapacitiveImpedance. 12. Program to Determine the Operating Range of Frequency for TE_{10} Mode of Air-Filled Rectangular Waveguide. 13. Program to Determine Directivity, Bandwidth, Beamwidth of Antenna. 14. Program to Determine Diameter of Parabolic Reflector. 15. Program to Find Minimum Distance between Primary and Secondaryantenna. 16. Simple Problems using Smith Chart.	

THE BHAWANIPUR EDUCATION SOCIETY COLLEGE

A MINORITY RUN COLLEGE. AFFILIATED TO UNIVERSITY OF CALCUTTA
RECOGNISED UNDER SECTION 2(F) & 12 (B) OF THE UGC ACT, 1956

PO CO mapping for Graduation Degree Course of Electronics Honours (CBCS)

Course Outcomes (CO)	Program Outcomes (PO)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
1.1.1	√	√		√	√	√	
1.1.2	√	√	√		√		√
1.2.1	√	√		√	√	√	√
1.2.2	√	√	√		√		√
2.1.1	√	√		√	√	√	
2.1.2	√	√	√		√		√
2.2.1	√	√			√	√	
2.2.2	√	√	√		√		√
3.1.1	√	√			√	√	
3.1.2	√	√	√		√		√
3.2.1	√	√			√	√	
3.2.2	√	√	√		√		√
3.3.1	√	√		√	√	√	
3.3.2	√	√	√		√		√
3.4.1	√	√	√	√	√		√
3.5.1	√	√	√	√	√		√
4.1.1	√	√			√	√	
4.1.2	√	√	√		√		√
4.2.1	√	√			√	√	
4.2.2	√	√	√		√		√
4.3.1	√	√			√	√	
4.3.2	√	√	√		√		√
4.4.1	√	√	√	√	√	√	√
4.5.1	√	√	√	√	√		√
5.1.1	√	√			√	√	
5.1.2	√	√	√		√		√
5.2.1	√	√			√	√	
5.2.2	√	√	√		√		√
5.3.1	√	√			√	√	
5.3.2	√	√	√		√		√
5.4.1	√	√			√	√	
5.4.2	√	√	√		√		√
5.5.1	√	√			√	√	
5.5.2	√	√	√		√		√
5.6.1	√	√			√	√	
5.6.2	√	√	√		√		√
6.1.1	√	√			√	√	
6.1.2	√	√	√		√		√
6.2.1	√	√			√	√	
6.2.2	√	√	√		√		√

6.3.1	√	√			√	√	
6.3.2	√	√	√		√		√
6.4.1	√	√			√	√	
6.4.2	√	√	√		√		√
6.5.1	√	√			√	√	
6.5.2	√	√	√		√		√
6.6.1	√	√			√	√	
6.6.2	√	√	√		√		√