Estd. 1962 NAAC 'A++' Grade

Faculty of Science and Technology
Syllabus For

B. Sc. Electronics
Part – I (Sem I & II)

(To be implemented from June 2024 onwards)

Preamble

The Bachelor of Science in Electronics program is meticulously crafted to provide students with a comprehensive and hands-on understanding of electronic principles. Our dedication is centered on helping students become proficient in organizing and carrying out electronic experiments. This entails mentoring students as they design experimental setups, carry out protocols, and collect data in an organized manner. Students are empowered to bridge the gap between theoretical knowledge and practical application through targeted training in analysis and interpretation.

Our curriculum transcends conventional boundaries by emphasizing the useful application of electrical and scientific knowledge in real-world scenarios. Students gain a thorough grasp of how electronic principles function in a variety of applications by learning how to easily incorporate theoretical ideas into practical solutions. This hands-on approach gives them the tools necessary to address practical issues in the field, promoting a comprehensive viewpoint that goes beyond theoretical boundaries.

Our programme places a strong emphasis on developing students' problem-solving skills across a wide range of electronics disciplines. Pupils develop the ability to define and methodically identify issues, refining their analytical and critical thinking skills to create workable solutions. Their ability to solve problems in multiple dimensions equips them to navigate and overcome challenges in a variety of electronics industry aspects, fostering resilience and adaptability.

Additionally, the programme emphasizes the importance of developing adaptability and collaborative skills. In addition to being taught how to be excellent individual contributors, students also learn how to work well in collaborative multidisciplinary teams. This focus on adaptability and teamwork abilities is combined with a strong dedication to moral behavior, social responsibility, and ethics. Students gain experience working in diverse teams and contributing effectively while adhering to the highest ethical standards and societal values through the dynamic framework of electronics projects.

Essentially, the goal of the B.Sc. in Electronics programme is to create well-rounded professionals who possess a solid ethical foundation, practical skills, and theoretical knowledge in addition to critical thinking abilities. Graduates enter the workforce ready to tackle the challenges of the rapidly evolving electronics industry, make a significant contribution, and uphold the values of morality and social responsibility.

The National Education Policy (NEP-2020) is in line with the B.Sc. in Electronics programme, which promotes ethical values, critical thinking, and practical skills for all-around development in the changing learning environment.

Program Outcome

- The programme places a strong emphasis on helping students become proficient in planning and carrying out electronic experiments. This entails creating experimental configurations, carrying out procedures, and gathering information. As a result of their training in analysis and interpretation, students are encouraged to apply their theoretical knowledge practically.

- The curriculum places a strong emphasis on using scientific and electrical knowledge in real-world contexts. Pupils gain a thorough understanding of how electronic principles function in a variety of applications by learning to integrate theoretical concepts into workable solutions. This practical approach equips them to tackle real-world problems in the field.

- Students acquire the capacity to define and systematically identify problems across a wide range of electronics disciplines. They learn how to use critical thinking and analytical techniques to create workable solutions. Their ability to solve problems in multiple dimensions equips them to tackle obstacles in a variety of aspects related to the electronics industry.

- The program instills a recognition of the lifelong learning imperative in the ever-evolving field of electronics. Students cultivate a proactive attitude towards continuous learning, embracing emerging technologies and industry advancements. This commitment equips them to adapt, grow, and stay current throughout their professional journeys.

- Students are trained to excel as collaborative members of multidisciplinary teams, emphasizing teamwork skills and adaptability. They showcase a strong commitment to ethical practices, integrity, and social responsibility within the dynamic context of electronics projects. This prepares them to contribute effectively to diverse projects while upholding ethical standards and societal values.

B. Sc. I – Electronics
Semester- I
Electronics Paper- I
DSC I – Electronic Circuit Elements (Total Marks 50)
Credits: 02 (Marks 50) Hours: 30

Course Outcome:

After completion of this course, the student will be able to

1. Select the right electronic parts according to the application's requirements.
2. Simplify various electronic circuits by utilizing network theorems.
3. Understand the basic circuit concepts like energy, power, resistance, voltage, and current.
4. Use Network theorems to evaluate and simplify intricate electrical networks made out of inductors, capacitors, and resistors

Unit	Contents	Hours Allotted
1	**Passive Circuit Elements–I** Definition of active and passive elements, Resistors: - Definition, symbol and color code method. Linear Resistors (Fixed): -Carbon composition resistor, Linear resistors (Variable): -Wire wound, Potentiometer, Preset. Non-Linear resistors: - Thermistors, photo resistors and Varistors [Specification and application], Capacitors: - Definition, Capacitance, capacitive reactance (XC), Energy stored in a capacitor, Charging and discharging of a capacitor, Inductors: - Definition, symbol, Inductance, Inductive reactance (XL), Energy stored in an inductor, Types of Inductors: - Air core, Iron core and ferrite core inductors.	8
2	**Passive Circuit Elements II** **T**ransformers: - Principle and construction of transformer, Specification of transformer. Types of Transformers: - Step-up, step-down transformer Types of Switches: Explanation using Symbols, relay explanation using symbols. Types of cables: -coaxial, OFC, CAT-6, CAT-5, armored cables, passive SMD components: advantages, resistor, resistors network, capacitors, resistor and capacitor codes, fuse, MCB.	6
3	**Circuit Fundamental** Electric circuit, Active and Passive elements, Bilateral and unilateral element, Linear and non-Linear element, Lumped and distributed element. Energy sources: - AC and DC sources, constant voltage and constant current source, and their inter-conversions, Reference direction for voltage and current. Sources of DC voltage: Lead-Acid and Ni-Cd Battery: Construction, Chemical action, Current rating. A.C. Fundamentals: Types of AC, Important terms of AC: Cycle, Time period, Frequency,Amplitude, peak, Peak to peak value, R.M.S. value, Phase, Phase Difference. Basic Voltage and Current relations for R, L and C.	8
4	**Network Theorems**	8

	Basic laws and rules: - Ohm's law, Kirchhoff's laws, voltage and current divider rules,power and resistance in series and parallel circuits. Concept of Mesh-analysis method and Nodal analysis method (only for dc resistive circuit) Network Theorems: - Thevenin's Theorem, Norton Theorem, Superposition Theorem, Maximum power transfer Theorem and Millman's Theorem. (only for dc resistive circuit)	
	Total	**30**

Reference Books:

- A Textbook of Applied Electronics: R. S. Sedha , S. Chand Publications
- Electronic Devices and Circuits: Allen Mottershed
- Basic Electronics and linear circuits: Bhargava- Gupta, TMH
- Electric Circuits, S. A. Nasar, Schaum's outline series, Tata McGraw Hill (2004)
- Electronic Devices and Circuits, David A. Bell, 5th Edition 2015, Oxford University Press.
- Electronic Circuits: Discrete and Integrated, D.L. Schilling and C. Belove, TMH
- J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)

B. Sc. I – Electronics
Semester- I
Electronics Paper- II
DSC-II – Digital Electronics - I (Total Marks 50)
Credits: 02 (Marks 50) Hours: 30

Course Outcome:

After completion of this course, the student will be able to

1. Learn multiple number systems and become proficient in their conversions.
2. Learn about logic gates and how they are used in real-world situations in Boolean algebra.
3. Students will be able to understand the concept and the application of the combinational logic.
4. Design the digital sequential circuits and its applications

Unit	Contents	Hours Allotted
1	**Number Systems** Number Systems: - Decimal, Binary, Octal, Hexadecimal number system and their inter-conversions.1's and 2's complement of Binary Numbers, Binary Arithmetic: - Addition, Subtraction, Multiplication and Division. Binary codes: - 8421 code, Excess- 3 code, Gray code, Alphanumeric codes ASCII, the parity Bit, bar code system, QR code	8
2	**Logic Gates and Boolean Algebra** Introduction to logic gates with IC's, DeMorgan's Theorems, The	8

	universality of NAND & NOR gate, current sinking & current sourcing, concept of fan in and fan out, Rules and Laws of Boolean Algebra, Boolean expressions for gate networks, Simplification of Boolean expressions, Sum of product and Product of sum method by using K-maps.	
3	**Arithmetic Circuits** Ex-OR gate and Controlled invertors, half adder, Full adder, 4-bit Parallel Binary adder, 8421Adder, Excess 3 adder, half and full sub tractor.	**6**
4	**Flip-Flops :** R S flip-flop, Clocked RS flip-flops , D-flip-flop, Positive and negative edge triggered D and JK flip flops, Race around condition, Pulse triggered (Master Slave) JK flip-flop,T flip flop, Study of ICs 7474, 7475 and 7476. Applications of flip-flop: Parallel Data storage, Data transfer and frequency division.	**8**
	Total	**30**

References

- Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011,
- Tata McGraw
- Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI
- Digital Fundamentals, Thomas L. Flyod, Pearson Education Asia (1994)
- Digital Principles, R. L. Tokheim, Schaums Outline Series, Tata McGraw- Hill (1994)

B. Sc. I – Electronics
Semester- I
DSC-I Electronics Practical

Course Outcome:

After completion of this course, the student will be able to,

1. Identify different technological devices and parts.
2. Understand how various laboratory instruments operate and use them to measure different parameters.
3. Verify different basic electric and electronic circuit laws.
4. Learn the workings of combinational logic circuits.

Practical

1. To Familiarize with Basic Electronic Components (R, C, L, Diodes, Transistors),
2. To Familiarize with Digital Multimeter, Function Generator and Power Supplies.

3. Measurement of Amplitude, Frequency & Phase Difference Using Oscilloscope.
4. To Verify the Superposition Theorems
5. To Verify the Thevenin and Nortan Theorem
6. To Verify the KCL And KVL
7. To Verify the Maximum Power Transfer Transform
8. Study of Logic Gates
9. Study of Multiplexer (4:1) and (8: 1)
10. 3. Demultiplexer (1 :4) and (1: 8)
11. Study any Boolean expression using K-map.
12. Study of Universal Gates
13. Study of De-Morgans Theorems.
14. Half Adder and Subtractor
15. Full Adder
16. Decimal to Binary Encoder
17. Study seven segment Decoder
18. Study RS, Clocked RS, D and JK flip flops.

B. Sc. I – Electronics
Semester- II
Electronics Paper- III (Major)
DSC-III – Semiconductor Devices (Total Marks 50)
Credits: 02 (Marks 50) Hours: 30

Course Outcome

After completion of this course the student will be able to,

1. Understand the semiconductor material and working principals
2. Understand the operating concepts and governing principles of semiconductor diodes.
3. Understand the working of Bipolar junction transistor and basic parameters.
4. Understand the working principal of Bipolar Junction Transistor (BJT), UJT,SCR DIAC and TRIAC .

Unit	Contents	Hours Allotted
1	**Semiconductor Basics** Difference between conductor, insulator and semiconductor, atomic structure of Si and Ge, energy levels, compound semiconductor, semiconductor materials: extrinsic and intrinsic (P and N type semiconductor), concept of hole and hole current, concept of donors, accepters and fermi-level.	6
2	**Semiconductor Diodes**	8

	PN junction, unbiased junction, formation of depletion layer and internal potential barrier, forward and reverse I-V characteristics of PN junction diode. Concept of static and dynamic characteristics, Diode applications, Zener diode, Breakdown mechanism, Zener and Avalanche Break down, Photo diode, Varactor diode, LED, seven segment display, tunnel diode, Solar Cell.	
3	**Bipolar Junction Transistor** Junction Transistor, Types, Construction of PNP and NPN Transistor. Configurations: - CB, CE and CC, I-V characteristics of CB and CE, definition of α and β. Relation between α and β, photo transistor, DC load line, Q-Point, need of transistor biasing, thermal runaway, voltage divider biasing, Transistor as switch (LED ON-OFF).	**8**
4	**Special Semiconductor Devices** Structure, operation, characteristics and Applications of JFET, MOSFET, UJT and SCR, TRIAC, DIAC- construction and applications, concept and working of optocoupler.	**8**
	Total	**30**

Reference Books:

- A Textbook of Applied Electronics : R. S. Sedha , S. Chand Publications
- Electronic Devices and Circuits: Allen Mottershed
- Basic Electronics and linear circuits: Bhargava- Gupta, TMH
- Electric Circuits, S. A. Nasar, Schaum's outline series, Tata McGraw Hill (2004)
- Electronic Devices and Circuits, David A. Bell, 5th Edition 2015, Oxford University Press.
- Electronic Circuits: Discrete and Integrated, D.L. Schilling and C. Belove, TMH
- J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)

B. Sc. I – Electronics
Semester- II
Electronics Paper- IV (Major)
DSC-IV – Digital Electronics - II (Total Marks 50)
Credits: 02 (Marks 50) Hours: 30

Course Outcome:

After completion of this course, the student will be able to,

1. Understand the concept of sequential digital electronics
2. Demonstrate knowledge in designing and analyzing shift registers and digital counters.

3. Understand the concept of data processing circuits and its applications.
4. Acquire extensive knowledge of analog-to-digital and digital-to-analog conversion methods.

Unit	Contents	Hours Allotted
1	**Counter Techniques** Basic counter operations, classification of counters, Asynchronous Counter: 3 Bit Binary counter (Binary Ripple Counter), Asynchronous, decade counter, four-bit binary counter IC 7493. Synchronous or parallel counter: - 3-bit synchronous counter, decade counter, Study of IC 74160 Series parallel combination counter: Mod-3, Mod-5, and Mod-7 counter, Study of IC 7490	8
2	**Shift Registers, Buffers and Latches** Shift register: Types of Shift registers - SISO, SIPO, PISO and PIPO ,shift left and shift right registers, Bi-directional shift register. Shift register counters: Ring counter, Johnson counter, up- down counter. Digital Clock (block diagram only), Study of IC 7495. Unidirectional Buffer, Bidirectional buffer, Tristate buffer, Study of buffer ICs : 74LS 244, Latch 74 LS 373	8
3	**Multiplexer, Demultiplexer , Decoder and Encoder** Multiplexers: - 2 to 1, 4 to 1 and 8 to 1 Mux, Mux –Tree. Demultiplexers: - 1 to 2 ,1 to 4 and 1 to 8 DEMUX, DEMUX Tree. Study of IC's 74150. Basic Binary decoders: 2 to 4 line and 3 to 8 lines, BCD to decimal decoder, BCD to seven-segment decoder driver, IC 7447. Encoder, Decimal to BCD Encoder, Priority Encoder, Study of IC 74147.	8
4	**Data Conversion** DAC: performance characteristics, 4-bit binary weighted and R-2R circuit and working. Accuracy and Resolution. ADC: performance characteristics, successive approximation ADC, Dual slope ADC (Mention of relevant ICs for all).	6
	Total	30

Reference Books:

- Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011,
- Tata McGraw
- Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI
- Digital Fundamentals, Thomas L. Flyod, Pearson Education Asia (1994)
- Digital Principles, R. L. Tokheim, Schaums Outline Series, Tata McGraw- Hill (1994)

B. Sc. I – Electronics
Semester- II
DSC-II Electronics Practical

Course Outcome:

After completion of this course the student will be able to,

1. Identify different digital ICs and functionality.
2. Design, develop and analyses the Digital circuits.

Group- B

1. To make a Shift Register (serial-in and serial-out) using D-flip-Flop ICs
2. Design of a 4-bit R-2R ladder digital to analog converter (DAC)
3. Decade Counter
4. Design of MOD 5 counter
5. To study ring Counter
6. Study of ADC IC 0804
7. Study of Transistor as A Switch
8. Study of the I-V Characteristics of PN Junction Diode
9. Study of the I-V Characteristics of Zener Diode
10. Study the Characteristics of Photodiode
11. Study of the I-V Characteristics of Common Source JFET
12. Study of the I-V Characteristics of BJT CB Configuration
13. .Study of the I-V Characteristics of BJT CE Configuration
14. Study of Voltage Divider Biasing Method
15. Photo Relay Using LDR

B. Sc. I – Electronics
Semester- I
OE Electronics Paper- I
OE-I – Home Appliances Maintenance and Repairing (Total Marks 50)

Credits: 02 (Marks 50) Hours: 30

Course Outcome:

After completion of this course the student will be able to,

1. Understand the working of home appliances
2. Repairing of home appliances.

Unit	Contents	Hours Allotted
1	**Introduction to Electricity -** origine, basic concept, importance, generation and transmission of electricity. electric circuit, effect on electric circuit, concept of voltage, current, frequency, resistor, inductor, capacitor and transformers. Parallel and series electric circuits. Difference between power and energy, use of voltmeter and ammeter.	7
2	**Electrical wiring components -** Wiring materials (conducting insulating and semiconductor), wiring accessories switch holder, celling rose socket outlet (coupler/ plug), main switch, PVC casing- capping and wiring. MCB, Uses of MCB, conduit wiring. Advantages and disadvantages of conduit wiring, concealed wiring advantage and disadvantage, wiring color code, types of electrical cables.	7
3	**Electric appliances-I** **Electric iron:** non-automatic and automatic electric iron, steam iron **Electric Heater:** open element and closed element electric heater, immersion water heater, electric geyser **Fans**: Ceiling fan, Table fan, Exhaust fan	8
4	**Electric appliances-II** **Electric Lamp:** Electric Tube, Incandescent lamp, Compact florescent Lamp, LED bulb, **Electric toaster:** Non-automatic toaster and automatic toaster, Electric bell, Electric Mixer and Grinder, Electric kettle.	8

OE Electronics Paper- II
OE-II – Home Appliances Maintenance and Repairing
Credits: 02

Course Outcome:

After completion of this course the student will be able to,

1. The working principals of home appliances.
2. Understanding of Repairing technique.

List of Experiments

1. Study of electrical Component and testing.
2. Study of digital multimeter.
3. Study of transformer.
4. Testing, fault finding and repairing of ceiling fan.
5. Testing, fault finding and repairing of table fan.
6. Testing, fault finding and repairing of exhaust fan.
7. Testing, fault finding and repairing of non-automatic electric iron.
8. Testing, fault finding and repairing of automatic electric iron.
9. Testing, fault finding and repairing of mixer and grinder.
10. Testing, fault finding and repairing of electric tube.
11. Testing, fault finding and repairing of LED bulb.
12. Testing, fault finding and repairing of adapter (charger).
13. Testing, fault finding and repairing of electric heater.
14. Testing, fault finding and repairing of electric kettle.
15. Testing, fault finding and repairing of electric oven.
16. Study of Switch and board connections.
17. Understand domestic wiring and layout

B. Sc. I – Electronics
Semester- I
OE Electronics Paper- I
OE-I – Solar Power Technology (Total Marks 50)
Credits: 02 (Marks 50) Hours: 30

Course Outcome:

After completion of this course, the student will be able to,

1. Learn the basics of electricity, solar energy and its measurement.
2. Learn about PV module arrays and their parameters, series and parallelconnections of PV modules.

Unit	Contents	Hours Allotted
1	**Introduction:** Basics of Electricity, Solar Radiation and Measurement, Net Metering, Measurement of Electrical and Non-Electrical Quantities, Solar Path, Working of Solar Cells and its functions, Solar Cell Parameters, Efficiency of Solar Cell	07

2	**Solar Photovoltaic:** Solar PV Modules, Solar PV Module Arrays, Safety in Installation of Solar PV Systems, Solar Technologies, Rating of Solar PV Module, PV Module Parameters, Efficiency of PV Module, Measuring Module Parameters. Connection of PV Module in Series and Parallel, Estimation and Measurement of PV Module Power, Selection of PV Module.	**08**
3	**Solar PV Systems Design and integration**: Basics of Charge Controller, Inverter Basics, Solar Batteries, how to audit an electricity bill, Site audit & assessment, Components Selection, Balance of Systems Components, PV Battery System Design, PV Controller System Design, PV Inverter System Design, Photovoltaic System Sizing.	**07**
4.	**Installation Process:** Estimating Energy requirement, Types of Solar PV System, Design methodology for SPV system, Design of Off Grid Solar Power Plant, Case studies of 3KWp Off grid Solar PV Power Plant, Design and Development of Solar Street Light and Solar, Lantern, Off Grid Solar Power Plant. Solar PV Plant Installation Check List, Installation of Solar PV Power Plants Plant Operation and Maintenance, Troubleshooting of Solar PV Power Plants.	**08**

OE-II – Solar Power Technology (Total Marks 50)

Credits: 02 (Minimum 8 Experiments)

Course Outcome:

After completion of this course, the student will be able to,

1. Learn the components of the solar power system.
2. Learn about the installation and integration of solar power components.

List of Experiments

1. Preparation of PV module datasheet
2. Preparation of cable sizing and selection
3. Introduction to Solar Cells
4. Technical Evaluations and Selection of Different Solar PV Module Technologies
5. Design of Strings/ Arrays of PV modules
6. Earthling and lightning arrester of PV Module Mounting Structure
7. AC distribution box DC distribution box and inverter installation
8. Study of various types of Batteries.
9. Study of Charge controller
10. Study of solar radiation and measurement
11. Solar tracking system
12. Installation of complete Solar systems
13. Study of different solar plants (Off-grid, On-grid and Hybrid)
14. Design and development of Solar Lantern.
15. Design and development of DC solar lighting system.

References

1. Solar Photovoltaic Technology and Systems- by Chetan Singh Solanki
2. Solar Energy Fundamentals, Designs, Modelling and Applications- by G.N. Tiwari

3. Fundamentals of Solar Energy -by Dr. R. Suresh Kumar
4. Understanding Photovoltaics -by Jay Warmke
5. Off-Grid Solar Power Made Easy: Design and Installation of Photovoltaic system For Rvs, Vans, Cabins, boats and tiny homes

B. Sc. I – Electronics
Semester- I
Electronics
IKS I – Growth and Development of Electronics in India (Total Marks 50)
Credits: 02 (Marks 50) Hours: 30

Course Outcome:

After completion of this course the student will be able to,

1. Learn about the important efforts, turning points, and technical developments that have shaped India's electronics industry's history.
2. Keep up with the latest developments, obstacles, and opportunities facing the Indian electronics sector.

Unit	Contents	Hours Allotted
Unit 1	**Growth and Progress of Electronics industry in India** An Introduction to growth and the progress of electronics sector India, history of trades in consumer electronics, regulations related to the electronics goods. Establishment of all India Radio, Doordarshan, Akashwani computer, television, color television, Prasar Bharati corporation DD. The growth of various segments of the electronics industry in telecommunications, consumer electronics, computer hardware and software.	**10**
Unit 2	**Indian Scientist** Biography of Sir JC Bose, invention of radio wave detector, patent, invention in wireless communication. Biography of Dr.C.V. Raman, Ramn effect and its application in Raman spectroscopy. Biography of Dr. V.P. Bhatkar, development of param supercomputer. Dr S. G. Pitroda biography. Development Centre for Development of Telematics. India Semiconductor Mission	**10**
Unit 3	**Electronics research institution in India** Government of India research laboratories Bharat Electronics, Defense research and development organization, semiconductor Laboratory Chandigarh, C-DAC, Central Electronics Engineering Research Institute (CEERI), Pilani. Indian space research organization. National informatic center. Ministry of Electronics & Information Technology, Government of India	**10**

References

1. Growth and Development of Mass Communication in india by J V Vilanilam National Book Trust.
2. The Indian Electronics Industry - Dhiraj Bansal, Rajdeep Sharma.
3. Indian Contribution to Science, compiled by Vijnana Bharati.
4. B.V. Subbarayappa, Science in India: A Historical Perspective, Rupa, New Delhi.

Marks Distribution of DSC Practical (LAB):

Group	DCS Practical I	Journal	Total
Marks	22	03	**25**

Group	DCS Practical II	Journal	Total
Marks	22	03	**25**

Marks Distribution of OE -II Practical (LAB):

Group	OE-II Practical (Two Experiments)	Journal	Total
Marks	22 X 2= 44	06	**50**

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