JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

OOTY ROAD, MYSURU- 570 025

DEPARTMENT OF ELECTRONICS

Curriculum for I and II year BSc

Degree under NEP

2022-23

Bachelor of Science with Electronics as one of the optional subject

Eligibility Criteria:

A candidate who has passed the two year Pre-University Examination with Science Subjects conducted by the Pre-University Board of Education, Government of Karnataka or any other examination considered equivalent by the University is eligible for admission to the first Semester of the UG program

Programme Outcome (Under NEP)

After completing the graduation in the Bachelor of Science the students are able to:

PO1	Acquire the knowledge of Basic and Advanced topics related to the field of Electronics
PO2	Apply the knowledge of Logic thinking and basic Science for solving Electronics related problems.
PO3	Ability to perform Electronics Experiments and analyse and interpret data.
PO4	Ability to design and manage Electronic Systems or Processes that conforms to a given specification within ethical and economic constraints.
PO5	Ability to identify, formulate, solve and analyse the problems in various sub disciplines of Electronics.
PO6	Ability to use Modern Tools/Techniques in solving problems in the field of Electronics..

Programme Specific Outcome (Under NEP)

Bachelor of Science with Electronics as one of the optional subject

PSO1	Find career opportunities.
PSO2	Develop competence to write competitive examinations.
PSO3	Develop proficiency in the analysis of complex physical problems.
PSO4	Create a hypothesis and appreciate how it relates to broader theories.
PSO5	Demonstrate skills in the use of Computers for control, data acquisition, and data analysis in experimental investigations.
PSO6	Apply appropriate troubleshooting techniques to Electronic circuits / systems and perform test procedures

Scheme of Evaluation:

- **The evaluation weightage for theory papers in DSC, DSE and OE courses**

Course	Theory			Total
	C1	C2	C3	
DSC	20	20	60	100
DSE	20	20	60	100
OE	20	20	60	100

- **Scheme for C1 and C2 Evaluation for Theory component of DSC/DSE/OE**

Sl. No.	Activity	C1	C 2
1	Test	10 marks	10 marks
2	Seminar/Book Review/Report on Data Sheets of Electronic Components, etc.		10 marks
3	Assignment/Mini Project Work/Case Study/ Report on Industry Visit, etc.,	10 marks	
Total		**20 marks**	**20 marks**

Scheme of Evaluation for Practicals

- The evaluation weightage for Practicals in DSC, DSE courses:

Course	Practicals				Total
	C1	C2	Record	C3	
DSC	10	10	05	25	50
DSE	10	10	05	25	50

- The student will be evaluated on the basis of skill, comprehension, and recording the results
- The student has to compulsorily submit the practical record for evaluation during C1, C2, and C3.
- A candidate appearing for the first time should submit a duly signed and certified practical record.

- **Scheme of assessment of C3 component in Practical Examination**

Division	Marks
Experiment	22
Viva	03

Scheme for Experiment Part assessment in Practical Examination

Division	Marks
Write up of the experiment - Circuit diagram , Tabular column, formula & Nature of Graph	06
Circuit connections	06
Taking and Recording Readings	05
Calculations and Plotting of Graph	04
Accuracy of Result	01
TOTAL	**22**

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE, MYSURU

Pattern of Question Paper for DSC/DSE/OE

Time: 3 Hours Max. Marks: 60

1. Answer any **TEN** of the following. 10 x 2 = 20

a)
b)
c)
d)
e)
f)
g)
h)
i)
j)
k)
l) .

Unit – 1

6 + 4 = 10

2.

a) Long answer type question for 6 marks

b) Short answer type question or Numericals for 4 marks

OR

3)

a) Long answer type question for 6 marks

b) Short answer type question or Numericals for 4 marks

Unit – 2

6 + 4 = 10

4

a) Long answer type question for 6 marks

b) Short answer type question or Numericals for 4 marks

OR

5)

a) Long answer type question for 6 marks

b) Short answer type question or Numericals for 4 marks

Unit – 3

6 + 4 = 10

6)

a) Long answer type question for 6 marks

b) Short answer type question or Numericals for 4 marks

OR

7)

a) Long answer type question for 6 marks

b) Short answer type question or numerical for 4 marks

Unit – 4

6 + 4 = 10

8

a) Long answer type question for 6 marks

b) Short answer type question or Numericals for 4 marks

OR

9)

a) Long answer type question for 6 marks

b) Short answer type question or Numericals for 4 marks

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Programme Structure for Electronics as one of the Core and Elective Courses under NEP-2020

Sem	Course type	Course Code	Title of the Course	Credits	Teaching hrs/Week
I	DSC Theory	**FSA 440**	Electronic Devices and Circuits	4:0:0	04
	DSC Lab	**FSA 443**	Electronic Devices and Circuits Lab	0:0:2	04
	OE 1.1	**FSA 860**	Fundamentals of Electronics and Domestic Wiring	3:0:0	03
	OE 1.2	**FSA 870**	Renewable Energy and Energy Harvesting	3:0:0	03
	OE 1.3		Application of Electronics – 1	3:0:0	03
II	DSC Theory	**FSB 440**	Analog and Digital Electronics	4:0:0	04
	DSC Lab	**FSB 443**	Analog and Digital Electronics Lab	0:0:2	04
	OE 2.1	**FSB 860**	Fundamentals of Semiconductor Devices	3:0:0	03
	OE 2.2	**FSB 870**	Domestic Equipment Maintenance	3:0:0	03
	OE 2.3		Modern Communication	3:0:0	03
III	DSC Theory	**FSC 440**	Programming in C and Digital Design using Verilog	4:0:0	04
	DSC Lab	**FSC 443**	Programming in C and Digital Design using Verilog	0:0:2	04
	OE 3.1	**FSC 860**	Medical Electronics	3:0:0	03
	OE 3.2	**FSC 870**	Augmented and Virtual Reality	3:0:0	03
	OE 3.3		Application of Electronics – II	3:0:0	03
IV	DSC Theory	**FSD 440**	ApplicationofElectronics-1	4:0:0	04
	DSC Lab	**FSD 443**	Application of Electronics-1 Lab	0:0:2	04
	OE 4.1	**FSD 860**	Medical Electronics	3:0:0	03
	OE 4.2	**FSD 870**	Augmented and Virtual Reality	3:0:0	03
	OE 4.3		Application of Electronics – II	3:0:0	03

Curriculum Contents

Semester- I - Electronic Devices and Circuits

Program Name	**BSc in Electronics**	Semester	**First Semester**
Course Title	Electronic Devices & Circuits **(Theory)**		
Course Code:	**FSA 440**	No. of Credits	**4**
Contact hours	**60**	Duration of SEA/Exam	**2.30hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives:

The objectives of the Course are to enable the student to understand

1. Principle of operation of passive components
2. Basics principles of network theorems
3. Analysis of Electronic circuits
4. Construction, operation and applications of semiconductor diode, BJT and special Purpose devices
5. Number systems, Boolean laws and methods of simplifications of Boolean expressions

Course Outcomes:

At the end of this course, students will be able to-

1. Explain the principles and behaviour of basic semiconductor devices.
2. Analyse basic networks using network theorems.
3. Apply the concepts to realize the circuits. As per the requirement
4. Build simple electronic circuits used in various applications
5. Evaluate the critical internal parameters of semiconductor devices for the given standard device models.
6. Demonstrate the working of analog and digital circuits as per the specifications

Unit - 1

Electronic Components: Passive components – R, L, and C, and their properties, V-I relation, mutual and self-inductance, Transformer and its working, Definition and list of Active components, Concept of Voltage and Current Sources, Electric Energy and Power. (Qualitative only).

Network Theorems: KCL, KVL and node analysis of circuits, Superposition, Thevenin's, Norton's, Maximum Power Transfer, and Reciprocity Theorems, inter-conversion between Thevenin's and Norton equivalent circuits, (For Circuits with DC Source)

Network Analysis: DC and AC analysis of RC and RL circuits, RLC Series and Parallel Resonant Circuits.

PN-junction Diode: Ideal and practical diodes, Formation of Depletion Layer, mention of diode equation, I-V characteristics, DC load line, Static and Dynamic resistance, Zener diode and its IV Characteristics, Reverse saturation current, Zener and avalanche breakdown.

Rectifiers: Half-wave and Full-wave centre-tap and bridge rectifiers, expressions for output voltage, PIV, ripple factor and efficiency, Operation with and without shunt capacitor filter. (Relevant Numericals wherever applicable). **15 Hours**

Unit - 2

Applications of Diode: Clippers, Clampers and Voltage Multipliers (Qualitative analysis only)

Voltage Regulator: Block diagram of regulated power supply, Zener diode as voltage regulator – circuit diagram, load and line regulation, Fixed and Variable IC Voltage Regulators (78xx, 79xx, LM317).

Special Semiconductor Devices: Construction, working principle, characteristics, symbol and applications of Varactor diode, Schottky diode, and Tunnel diode, Solar Cell.

Display Devices: Construction, working principles, characteristics, symbol, and applications of LED and LCD, operation of 7-segment display, common anode and common cathode type 7-segment display. (Relevant Numericals wherever applicable) **15 Hours**

Unit - 3

Bipolar Junction Transistor: Construction and working of NPN transistor, CE, CB and CC configurations (mention only), Input and Output characteristics of a transistor in CE mode - Regions of operation of BJT (active, cut off and saturation), leakage currents (mention only), Current gains α , β and their inter-relations, dc load line and Q point.

Applications of Transistor: Circuit and working principles of Transistor as an amplifier and switch.

Transistor Biasing: Fixed and Voltage Divider Bias. Thermal runaway, mention of stability and stability factor, Transistor as a two-port network, h-parameter equivalent circuit for CE configuration.

Amplifier: Small signal analysis of single-stage CE amplifier using h-parameters, Frequency Response, Input and Output impedances, Current and Voltage gain.

Multi-stage Amplifiers: Types of coupling of amplifiers, Two-stage RC Coupled Amplifier – circuit, working and its Frequency Response, loading effect, GBW product.

Power Amplifiers: Class A, B and C Power Amplifiers (qualitative).

(Relevant Numericals wherever applicable) **15 Hours**

Unit - 4

Number System: Decimal, Binary, Octal and Hexadecimal number systems, base conversions. Representation of signed and unsigned binary numbers, Binary arithmetic - addition, subtraction by 1's and 2's complement method, BCD code (8421, 2421, Excess-3), Gray code - Gray to binary interconversion, parity error checking, single-bit error correction codes.

Boolean Algebra: Constants, variables, operators, SOP and POS form, canonical form, conversion form SOP to POS and Vice-versa, Boolean laws, Duality Theorem, De Morgan's Theorem.

Logic gates: AND, OR, NOT, Derived logic gates (NAND, NOR, XOR & XNOR). Universal property of NOR and NAND gates. Simplification and realization of Boolean expressions using gates. (Relevant Numericals wherever applicable) **15 Hours**

Reference Books:

1. Robert L Boylestad, and Louis Nashelsky, "Electronic Devices & Circuit Theory," 11th Edition, Pearson Education India, 2018.

2. Ravish R Singh, "Network Analysis and Synthesis," 1st Edition, MGH, 2018.

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3. Robert L Boylestad, "Introductory Circuit Analysis," 15th edition, Pearson, 2015.

4. R. S. Sedha, "A Text book of Applied Electronics," 7th edition., S. Chand and Company Ltd., 2011.

5. A. P. Malvino, and, David J Bates, "Electronics Principles," 7th Edition, TMH, 2011.

6. David A. Bell, "Electronic Devices and Circuits," 5th Edition, Oxford Uni. Press, 2015.

7. Thomas L. Floyd, "Digital Fundamentals," 11th Edition, Pearson Education, 2015.

8. A.P. Malvino, D. P. Leach, and Saha, "Digital Principles and Applications," 8th Edition, TMH, 2014.

9. K. R. Venugopal, K. Shaila, "Digital Circuits and Systems," 1st Edition, TMH, 2011.

Electronic Devices and Circuits -Practicals

Program Name	**BSc in Electronics**	Semester	**First Semester**
Course Title	Electronic Devices & Circuits **(Practicals)**		
Course Code:	**FSA 443**	No. of Credits	**2**
Contact hours	**60**	Duration of SEA/Exam	**3 hours**
Formative Assessment Marks	**25**	Summative Assessment Marks	**25**

PART - A

1. Verification of Thevenin's, Norton's, and Maximum Power Transfer Theorems
2. Study the I-V Characteristics of p-n junction and Zener diodes.
3. Study of Half and full wave rectifiers without and with shunt capacitor filter and to find the Ripple factor for different values of load resistance.
4. Study of Zener diode as a voltage regulator using bridge rectifier with shunt capacitor filter and to find the Load and Line regulation.
5. Study of clipping and clamping circuits.

PART – B:

6. Study of Transistor characteristics in CE configuration – determination of h-parameters.
7. Study of Voltage divider bias circuits.
8. Study of single stage CE amplifier and to draw its frequency response and to determine the input and output impedances in mid-band.
9. Study of Series and Parallel Resonance circuits.
10. Verification of truth tables of OR, AND, NOT, NAND, NOR, XOR and XNOR gates using Respective ICs and Realization of basic gates using universal gates.
11. Binary to Gray and Gray to Binary code conversion and parity checker using XOR IC 7486.

Open Electives Course – 1.1

Fundamentals of Electronics and Domestic Wiring

Program Name	**BSc in Electronics**	Semester	**First Semester**
Course Title	Fundamentals of Electronics and Domestic Wiring		
Course Code:	**FSA 860**	No. of Credits	**3**
Contact hours	**48**	Duration of SEA/Exam	**3 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives

The objectives of the Course are to enable the student to understand

1. Ability to gain the knowledge of basic electronics and electronic components.
2. Ability to analyse various components behaviour in AC and DC circuits.
3. Ability to get the knowledge of electrical wiring and safety precautions.
4. Provide students with learning experiences that develop broad knowledge and understanding of key concepts of electrical and electronics.
5. Provide students with skills that enable them to get employment in various organisations, industries, and turn as entrepreneurs.

Unit – 1: **12 Hours**

Introduction to Electronics: Evolution of Electronics, Definition and expression for of Charge, Current, Voltage, Potential Difference, Power, Energy. Coulombs Law, Ohm's Law.

Electronic Components: Definition and list of passive and active components.

Resistors: Definition, application, and mention of types of resistors, colour coding of resistors, series and parallel combinations.

Capacitors: Definition, application and mention of types capacitors, series and parallel combinations, factors affecting capacitance, colour coding of capacitors.

Inductors: Definition, application, and mention of types of inductors, series and parallel combinations. Self and mutual inductance, factors affecting inductance.

Unit – 2: **12 Hours**

Kirchhoff's laws: KCL and KVL, voltage divider rule and current divider rule, open and short circuits.

Network Theorems (DC analysis only): Thevenin's theorem, Norton's theorem and maximum

Power transfer theorem, Superposition Theorem (Qualitative Approach with statements and steps involved in solving) as applied to simple T-network.

DC power supplies: Block diagram and working, Applications.

Cells and Batteries: Primary and Secondary cells, Mention of types of batteries, series and parallel combination of batteries.

Lead Acid Battery: Construction, Internal resistance, Efficiency and capacity of a battery, condition of a fully charged and discharged lead acid battery.

Unit – 3: 12 Hours

A. C. Fundamentals: Definition and waveform of ac signal. Definition of Amplitude, Frequency, Time period, RMS value, average value, Phase and phase angle difference of sinusoidal signal. Sinusoidal signal applied to resistor, capacitor and Inductor, waveforms and phasor diagram for each. Expression for capacitive and inductive reactance. Circuit diagram and working of series and parallel resonance circuits, expression for resonance frequency.

Transformers: Definition, construction, working principle and application, step-up and step-down transformers.

Unit – 4: 12 Hours

Domestic Wiring: Introduction, Types of Domestic Wiring, Cleat Wiring, Wooden/PVC Casing and Capping Wiring, Toughened Rubber Sheath (TRS or CTS) or Batten Wiring, Conduit Wiring, Specifications of Wires, Size of Conductor, Distribution Board, Types of Cables, Lighting Control Circuits, Earthing System, Fuses and HRC Fuses, Calculation of Fuse Rating.

Switches: Definition and application of switch, Brief note on SPST, SPDT, DPST and DPDT, electromagnetic relay, MCB, ELCB, RCCB, Toggle switch, push button, joystick, selector, limit, proximity switches.

Reference Books:

1. C L Wadhwa, "Basic Electrical Engineering," 4th Edition, New Age International Publisher, 2007.
2. Robert Boylstead, "Introductory circuit analysis," 5th edition, PHI, 2010.
   Robert Boylstead and Louis Nashelsky, "Electronic Devices and circuit theory," 9th
3. Edition, PHI, 2013.
4. B. L. Theraja and A. K. Theraja, "ABC of Electrical Engineering," S Chand Publishers,
5. New Delhi, 2014.
6. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering," Pearson Education India, 2012.
7. I. J. Nagrath, "Electronic Devices and Circuits," PHI Learning Pvt. Ltd., 2007.
8. V. Mittle and Arvind Mittle, "Basic Electrical Engineering," McGraw Hill Companies, 2005.
9. Mitchel E. Schultz, "Basic Electronics," 10th Edition, TMH, 2010.

Open Electives Course -1.2

Renewable Energy and Energy Harvesting

Program Name	**BSc in Electronics**	Semester	**First Semester**
Course Title	**Renewable Energy and Energy Harvesting**		
Course Code:	FSA 870	No. of Credits	**3**
Contact hours	**48 Hours**	Duration of Exam	**2 ½ Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Note: This Course is for candidates who have not opted Electronics as one of the Core Courses.

Course Objectives:

The objectives of the course are

- To enable the students to understand the importance of non-conventional energy systems
- Understand the method of energy harvesting using solar energy, wind energy, hydro energy, etc.
- Know the principle of operation of piezoelectric effect and its use in energy harvesting
- Get the knowledge on electromagnetic energy harvesting methods

Course Outcomes:

The outcome of course are

- To understand the principle of operation of solar, wind, ocean energy, etc.
- To understand the principle of operation of piezoelectric energy and electromagnetic energy harvesting methods

Contents

Unit 1	12 Hrs

Fossil fuels and Alternate Sources of energy: Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

Unit 2	12 Hrs

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models, equivalent circuits, and sun tracking systems.

Unit 3	12 Hrs

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines, Power electronic interfaces, and grid interconnection topologies. **Ocean Energy:** Ocean Energy Potential against Wind and Solar, Wave Characteristics, and Statistics, Wave Energy Devices. Tide Energy Technologies, Ocean Thermal Energy, Ocean Bio-mass. **Geothermal Energy:** Geothermal Resources, Geothermal Technologies.

Unit 4	12 Hrs
Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources. **Piezoelectric Energy harvesting:** Introduction, Physics and characteristics of piezoelectric effect, Piezoelectric energy harvesting applications. **Electromagnetic Energy Harvesting:** Linear generators, recent applications.	

Reference Books	
1	B.H. Khan, "Non-conventional energy sources," 2nd Edition, TMH, 2017.
2	Suhas P Sukhative, "Solar energy," 8th Edition, TMH, 2008.
3	Godfrey Boyle, "Renewable Energy, Power for a sustainable future," 3rd Edition, Oxford University Press, 2012.
4	D.P.Kothari, "Renewable Energy Sources and Emerging Technologies," 2nd Edition, PHI, 2011.
5	Jayakumar, P., "Solar Energy Resource Assessment Handbook," Renewable Energy Corporation Network for the Asia Pacific, 2009.
6	John R. Balfour, "Introduction to Photovoltaic System Design," 1st Edition, Jones and Bartlett Publishers, 2011.
7	http://en.wikipedia.org/wiki/Renewable_energy.

Open Electives Course -1.3

Applications of Electronics – I

Program Name	**BSc in Electronics**	Semester	**First Semester**
Course Title	**Applications of Electronics – I**		
Course Code:		No. of Credits	**3**
Contact hours	**48 Hours**	Duration of Exam	**2 ½ Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Note: This Course is for candidates who have not opted Electronics as one of the Core Courses.

Course Objectives:

The objective of the course are:

- Students able to identify electronic components
- Able to understand the working of biomedical equipment and power supply.

Course Outcome:

The outcome of the course are:

- Students get awareness about different applications of electronic equipments
- To understand the working of biomedical instruments, power supply, inverters and calculators.

Contents

Unit 1	12 Hrs

Basic electronics: Introduction to circuit components- Resistor and its types, Capacitor and types, Inductor and its types,
Transformer: -Working principle of transformer with diagram, Step-down and Step-up Transformer.
Diode: - symbols of PN junction diode and Zener diode.
Transistor:- Symbols of NPN and PNP transistors and applications.
LED, LCD display, relay, fuse, and switch: Definitions, symbols and applications.

Unit 2	12 Hrs

Biomedical instruments- Working principles and applications of ECG, EEG, EMG, pH meter, X- ray, sphygmomanometer, Glucometer, Digital thermometer.

Sensor- Working principles and applications of OMR, MICR, Scanner and its types, Barcode reader.

Unit 3	12 Hrs

Power supplies: Dc power supply- block diagram with explanation, applications. **Rectifiers: W**orking principles of half wave and full wave rectifiers using block diagram, **Inverter, UPS, Adopter, SMPS and Mobile charger:** Working principles using block diagram.	
Unit 4	12 Hrs
Electronic calculators: Introduction, History of calculator. Types-Basic, business, solar powered, scientific calculators-block diagram working, calculator Key pad uses, calculators use in mathematical operations-addition, and subtraction, multiplication, division, % and Average calculation applications/uses of calculator. Differences between basic and scientific Calculators.	

Semester- II - Analog and Digital Electronics

Program Name	**BSc in Electronics**		Semester	**Second Semester**
Course Title	Analog and Digital Electronics **(Theory)**			
Course Code:	**FSB440**		No. of Credits	**4**
Contact hours	**60**		Duration of SEA/Exam	**2.30hours**
Formative Assessment Marks	**40**		Summative Assessment Marks	**60**

Course Objectives:

The objectives of the Course are to enable the student to understand

1. Principle of operation active devices like, BJT, FET, Op-Amp, UTJ, SCR, etc.,
2. Understand different applications of op-amp.
3. Analysis of Electronic circuits.
4. Construction, operation and applications oscillators.
5. Digital Logic Families and their comparison.
6. Understand, analyse and simply combinational and sequential digital logic circuits.

Course Outcomes

At the end of this course, students will be able to

1. Explain the working principles of semiconductor devices like JFET, MOSFET, UJT, SCR, Diac and Triac.
2. Design and build the circuits to understand the applications of op-amp.
3. Demonstrate and understand the working of combinational and sequential logic circuits

Unit – 1: **15 Hours**

JFET: Construction, working, Symbol, and I-V characteristics of p-channel and n-channel JFET, mention of different parameters and their relation in JFET, Comparison of BJT and JFET.

MOSFET: Construction, working, Symbol, drain and transfer characteristics of E-MOSFET, D-MOSFET, VMOS, UMOS. MOS Logic and its switching action, NMOS Inverter, CMOS and its characteristics, CMOS logic, Circuit and working of CMOS inverter, Construction and working of IGBT. Comparison of MOSFET, CMOS, and IGBT.

UJT: Construction, working, Symbol, I-V characteristics, equivalent circuit and parameters of UJT. Mention of equivalent circuit and I-V characteristics, working principles of UJT based Relaxation Oscillator.

SCR: Construction, working, Symbol, I-V characteristics, and two-transistor equivalent circuit of SCR, working principles of half-wave and full-wave controlled rectifiers.

Diac and Triac: Construction, working, Symbol, I-V characteristics and applications of Diac and Triac. Working principle of Triac as an AC-voltage controller.

(Relevant Numericals wherever applicable)

Unit – 2 **15 Hours**

Operational Amplifier: Basics of Differential Amplifier, Block diagram of Op-Amp, Characteristics of an Ideal and Practical Op-Amp, Open and closed loop inverting and non-inverting amplifiers, concept of virtual ground, Derivation for voltage gain, definition and expression for op-amp parameters – input/output impedance, offset voltage, CMRR, Slew Rate, Frequency Response.

Applications of Op-amp: Concept of feedback, negative and positive feedback, advantages of negative feedback (Qualitative Study). Inverting and non-inverting amplifiers, Summing and Difference Amplifier, Differentiator, Integrator, Comparator, and Zero-crossing detector.

Filters: Definition and types of filter, active verses passive filters, First and Second order active low pass, high pass and band pass Butterworth filters.

Oscillators: Definition and working principle of oscillator, concept of negative feedback, Barkhausen criterion for sustained oscillations, Colpitt's and crystal oscillators, RC-Phase Shift and Wien-bridge oscillator (no derivation for each)

IC 555 Timer: Introduction, Block diagram, Circuit diagram and working of Astable and Monostable multivibrator circuits. (Relevant Numericals wherever applicable)

Unit – 3 **15 Hours**

Logic Families: Pulse characteristics, Logic Families- classification of digital ICs. Characteristics of logic families, circuit description of TTL NAND gate with totem pole and open collector. TTL IC terminology, CMOS NAND Logic, comparison of TTL and CMOS families.

Combinational Logic Circuits: Minimisation techniques using K-maps - SOP and POS, Minterm, Maxterm, SSOP, SPOS, Simplification of Boolean expressions, K-Map for 3 and 4 variables.

Arithmetic Logic Circuits: Half Adder, Full Adder, Half Subtractor, Full Subtractor, 4 – bit parallel binary adder, 2 – bit and 4 – bit magnitude comparator.

Encoder and Decoder: Decimal to BCD priority encoder. Decoders: - 2:4 decoder using AND gates, 3:8 decoder using NAND gates, BCD to decimal decoder, BCD to 7-Segment decoder.

Multiplexer and Demultiplexer: 4:1 and 8:1 multiplexer, 1:4 and 1:8 demultiplexer, Realization of Full adder and Full Subtractor using Multiplexer and Decoder.

DAC and ADC: DAC with binary weighted resistor and R-2R resistor ladder network, Successive approximation based ADC and the mention of their performance characteristics.
(Relevant Numericals wherever applicable)

Unit – 4 **15Hours**

Sequential Logic Circuits: SR Latch, RS, D and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Pre-set and Clear operations. Race-around conditions in JK Flip-Flop. Master- Slave JK and T Flip-Flops. Applications of Flip-Flops in semiconductor memories, RAM, ROM and types.

Shift Registers and Counters: Types of Shift Registers - Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (4-bits only), Synchronous verses asynchronous counters, Ring and Johnson counters, 4-bit ripple counter, modulo-n counters, 4-bit Up-Down counter, 4-bit Synchronous counter, design of Mod 3, Mod 5 and decade Counters using K-maps.

Reference Books:

1. Robert L Boylestad, and Louis Nashelsky, "Electronic Devices & Circuit Theory," 11th Edition, Pearson Education India, 2018.
2. R. S. Sedha, "A Text book of Applied Electronics," 7th edition., S. Chand and Company Ltd., 2011.
3. David A. Bell, "Electronic Devices and Circuits," 5th Edition, Oxford Uni. Press, 2015.
4. R. A. Gayakwad, "Op-Amps and Linear Integrated Circuit," 4th Edition, Pearson Education, 2000.
5. David A. Bell, "Operational Amplifiers and Linear ICs," 3rd Edition, Oxford University Press, 2011.
6. Thomas L. Floyd, "Digital Fundamentals," 11th Edition, Pearson Education, 2015.
7. A.P. Malvino, D. P. Leach, and Saha, "Digital Principles and Applications," 8th Edition, TMH, 2014.
8. K. R. Venugopal, K. Shaila, "Digital Circuits and Systems," 1st Edition, TMH, 2011.

Analog and Digital Electronics –Practicals

Program Name	**BSc in Electronics**	Semester	**Second Semester**
Course Title	Analog and Digital Electronics **(Practicals)**		
Course Code:	**FSB 443**	No. of Credits	**2**
Contact hours	**60**	Duration of SEA/Exam	**3 hours**
Formative Assessment Marks	**25**	Summative Assessment Marks	**25**

PART- A

1. Study the JFET characteristics and obtain the frequency response and calculate band width of single stage JFET amplifier.
2. Study of inverting and non-inverting amplifier, adder, Subtractor, and averaging amplifier using Op-amp
3. Study of differentiator and integrator using op-amp for different input waveforms.
4. Design and study Colpitt's and RC phase shift oscillator using op-amp.
5. Obtain the frequency response of first order low-pass and high-pass filters using op-amp.
6. Study of Astable and Monostabe multivibrators using IC 555 timer.

PART- B

1. Study of Half and Full Adder, half and full Subtractor using NAND gates.
2. Study of 4 - bit parallel binary adder and Subtractor using IC.
3. Study of Clocked RS, D and JK Flip-Flops using NAND gates.
4. Study of BCD to decimal decoder using IC, Encoders and priority encoders.
5. Study of Multiplexer and Demultiplexer using ICs.
6. Study of 4-bit asynchronous counter using JK Flip-Flop.
7. Study of 4-bit Shift Register – SISO, modification to ring counter using IC.
8. Study of Digital to Analog Converter using binary weighted resistor method

Open Electives Course -2.1

Fundamentals of Semiconductor Devices

Program Name	**BSc in Electronics**	Semester	**Second Semester**
Course Title	Fundamentals of Semiconductor Devices		
Course Code:	**FSB 860**	No. of Credits	**3**
Contact hours	**48**	Duration of SEA/Exam	**2.30 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives:

The objectives of the Course are to enable the student to understand

1. Ability to gain the knowledge of Semiconductors devices.
2. Ability to get the applications of semiconductor devices.
3. Provide students with learning experiences that develop broad knowledge and understanding of semiconductor devices and its applications.

Unit – 1 **12 Hours**

Introduction to Semiconductors: Structure of a matter, conductors, insulators and semiconductors with examples to each, Energy band diagrams, intrinsic and extrinsic semiconductors. Definition of doping, dopant, donor, and acceptor, p-type and n-type semiconductors and their comparisons.

Diode: Construction, working, symbol, I-V characteristics and mention of application of pn junction diode. Ideal verses practical diodes, mention of different types of diodes and their symbolic representations.

Zener Diode: Construction, working, symbol, I-V characteristics and mention of application of zener diode, Zener and avalanche breakdown.

LED: Construction, working, symbol, and mention of application of LED, seven segment display and its applications.

Unit – 2 **12 Hours**

Rectifiers: Circuit diagrams, working and waveforms of half wave, full wave canter tap and bridge rectifiers. Mention of ripple factor and efficiency to each.

Filters: Definition of filter, circuit diagram and working of rectifiers with and without shunt capacitor filter. Mention of ripple factor with and without filter.

Voltage Regulator: Definition and applications, Circuit diagram and working of zener diode,voltage regulator, load and line regulation. Block diagram of regulator power supply and its applications.

Wave-shaping Circuits: circuit diagram and working of positive, negative clippers and clampers.

Unit – 3: 12 Hours

BJT: Construction, working principle, symbol of NPN bipolar junction transistor, Mention of CE, CB, CC configurations, Definition of α, β and and their interrelations, Characteristics of a transistor in CE mode. Circuit diagram and working principle of transistor as a switch.

JFET: Construction, working principle, symbol of N channel FET, Difference between P and N channel FET, comparison of FET with BJT.

MOSFET: Construction, working and symbol of depletion type and enhancement type MOSFET.

Unit – 4 12 Hours

Transistor Biasing: Need for biasing, DC load line, operating point. Circuit diagram and working of Voltage divider bias circuit.

Amplifier: Circuit diagram and working of single stage CE amplifier, frequency response, definition of gain, bandwidth, lower and higher cut-off frequency, application of amplifiers. Block diagram and working of Multistage amplifier and expression for gain.

Oscillator: Definition and concept of positive and negative feedback, Barkhausen's criterion for sustained oscillation, Circuit diagram and working of RC phase shift oscillator using transistor.

Reference Books:

1. Robert Boylstead, "Introductory circuit analysis," 5th edition, PHI, 2010.
2. Robert Boylstead and Louis Nashelsky, "Electronic Devices and circuit theory," 9th Edition, PHI, 2013.
3. B. L. Theraja and A. K. Theraja, "ABC of Electrical Engineering," S Chand Publishers, New Delhi, 2014.
4. R.S. Sedha, "A Text book of Electronics," S Chand and Co., Multicolour, 3rd edition, 2012.

Open Elective Course -2.2

Domestic Equipment Maintenance

Program Name	**BSc in Electronics**	Semester	**Second Semester**
Course Title	Domestic Equipment Maintenance		
Course Code:	**FSB 870**	No. of Credits	**3**
Contact hours	**48**	Duration of SEA/Exam	**2.30 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives

The objectives of the course are

1. To enable the students to understand the working principle of domestic equipments.
2. Identify the common faults that occur in the domestic equipment.
3. Able to carry out minor repairs in the equipments.
4. Understand the technical specifications of the equipments.

Unit-1 **12 Hours**

Microwave Oven: Working, parts, Common faults and their troubleshooting: Microwave does not heat, runs then stops, buttons do not work, plate do not spin, bulb does not turn ON during operation, sparking inside, shuts OFF after few seconds. Demonstrate the working of microwave oven.

Geyser: Construction and working, parts and types. Common faults and their troubleshooting: Dripping geyser overflow, overheating, steam or hot water escaping from overflow, water leaking through the ceiling, no hot water, water not hot enough, poor hot water pressure. Demonstrate the working of Geyer.

Unit – 2 **12 Hours**

Induction Cooker: Construction and working, parts and types. Common faults and their troubleshooting: Cooker fuse blown, cooker buttons not working, cook top shuts off while cooking, food not get cooked or heated properly, overheating and uneven heating, display keep flashing, weird noises, crackling, fan noise, humming sound, clicking. Demonstrate the working of induction cooker.

Unit – 3 **12 Hours**

Refrigerator: Working, electrical wiring diagram, types of refrigerator. Common faults and their troubleshooting: Fridge not cooling, fridge not defrosting, leaking water, freezing food light not working, freezer is cooled but fridge stays warm, dead refrigerator, not enough cooling, keeps

running, leakage, makes noise. Replacement procedure for: seal (gasket), evaporator fan motor, PTC relay, thermostat, compressor, bulb. Demonstrate the working of refrigerator.

Unit – 4 **12 Hours**

Air Conditioner: Working, electrical wiring diagram, types. Common Faults and their troubleshooting: Faults in following parts of AC: Filter, thermostat, refrigerant leaks, breakers, capacitors, compressor, evaporator coils, condenser coils, warm contactor. General faults : AC unit has an odour, shuts ON and OFF repeatedly, does not blow cold air, repeatedly tripping a circuit breaker, indoor unit is leaking water inside the room, outdoor unit is making an unusually loud sound, room is not getting cold enough, AC not turning ON. Demonstrate the working of air conditioner.

Reference Books:

1. R. G. Gupta, "Electronic instruments and systems: Principles, maintenance and troubleshooting," TMH, 2001.
2. R. S. Khandpur, "Troubleshooting Electronic Equipment: Includes Repair & Maintenance," TMH, 2013.
3. G. C. Loveday, "Electronic fault diagnosis," Pearson Education, 1994

B.Sc.

Open Elective Course -2.3

Modern Communication

Program Name	**BSc in Electronics**	Semester	**Second Semester**
Course Title	**Modern Communication**		
Course Code:		No. of Credits	**3**
Contact hours	**48 Hours**	Duration of Exam	**2.30 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Note: This Course is for candidates who have not opted Electronics as one of the Core Courses.

Course Objectives:

The objectives of the courses are::

- Understand the importance of digital electronics.
- Ability to explain the block diagram of cellular mobile phone network.
- Understand the concept of optical fiber communication, satellite and RADAR communication.

Course Outcomes:

Upon the completion of this course, students have the ability to:

- Explain the block diagram of cellular mobile phone network.
- Understand the principle of internet, blue tooth.
- Know the advantages of the optical fiber communication, satellite and RADAR communication.

Contents

Unit 1	12 Hrs

Introduction to Digital electronics: Introduction, importance of digital electronics, representation of digital signals. **Number system-** Decimal number system, Binary number system- bit, nibble and byte, binary to decimal conversion and decimal to binary conversion and Binary addition.

Logic gates: Basic gates- AND, OR, NOT gates -definition, logic symbol and truth table.

Unit 2	12 Hrs

Cellular mobile phone network: Introduction, evolution of telephones, block diagram of communication system, function of various blocks, transmission mode- simplex, duplex, half duplex and full duplex. Features of recent mobile phone – color LCD screen, digital camera, email, games, GPS, internet access, blue-tooth push-to-talk, voice recognition,

videoconferencing.

Unit 3	12 Hrs
Internet - introduction, LAN, WAN, MAN, WWW. Wi-Fi and Blue tooth – applications. **Optical fiber communications** - principle, block diagrams and explanation and advantages of fiber optic communication.	
Unit 4	12 Hrs
Satellite communication Systems: basic block diagram, function of each block, applications. **Radar Communication system**: Introduction, principle, basic block diagram, function of each block, frequency range, types and applications.	

Reference Books	
1	Thomas L. Floyd, "Digital Fundamentals," 11th Edition, Pearson Education, 2015.
2	George Kennedy, "Electronic Communication Systems," TMH, 4th Edition, 1999
3	D. Roddy and J. Coolen, "Electronic Communications," Pearson Education India, 4th Edition
4	Tomasi, "Advanced Electronics Communication Systems," 6th Edition, Prentice Hall.
5	Dennis Roddy and Coolen, "Satellite Communication," 4th edition, McGraw Hill, 2006.

Semester – III - Programming in C and Digital Design using Verilog

Program Name	**BSc in Electronics**	Semester	**Third Semester**
Course Title	**Programming in C and Digital Design using Verilog(Theory)**		
Course Code:	**FSC440**	No. of Credits	**4**
Contact hours	**60**	Duration of SEA/Exam	**2.30hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course objectives:

After completing the course, students will be able to:

- Familiarize the difference constructs of Verilog HDL.
- Understand Verilog tasks and directives.
- Impart the concepts of Verilog HDL, Dataflow and behavioural models for the design of digital systems.
- Learn C language features and realize its importance with Verilog HDL.

Unit I **15 Hours**

Over view of Digital design with Verilog HDL: Evolution of CAD, emergence of HDLs, typical HDL-flow, Need o f Verilog HDL, trends in HDLS.

Hierarchical Modeling Concepts: Top-down and bottom-up design methodology, Differences between modules and module instances, parts of a simulation, design block, Stimulus block.

Basic concepts: Lexical Conventions, data types, system tasks and Compiler Directives.

Modules and Ports: Module definition, port declaration, connecting the ports, hierarchical name referencing

Unit II **15 Hours**

Gate level modeling: Modeling using basic Verilog gate primitives, Description of OR, AND and NOT basic gates, rise, fall and turn- off delays, min, max and typical delays.

Data flow modeling: Continuous assignments, delay specifications, expressions, operators, operands, operator types.

Behavioral Modeling: Structured procedures, initial and always, blocking and delay control, event control, conditional statements, multi way branching, loops. non-blocking statements, delay control, event control, conditional statements, multi way branching, loops

Unit - III **15 Hours**

Basics of C Programming

Overview of C: Developing programs in C, Parts of simple C program (Sample C programs), structure of a C program, Programming Style, character Set, C tokens , keywords & Identifiers, constants, variables , data types.

Operators and Expressions: Arithmetic, relational, logical, assignment, increment & decrement, conditional, bitwise special operators, Arithmetic expressions, Expression evaluation-Precedence and associativity, type conversions.

Input–Output: Non-formatted and formatted inputs and out-put function and library functions

Unit - IV **15 Hours**

Decision making, branching & looping: if, if-else, nested if, nested if-else, switch**,** while, for, do-while, special control statement-goto, break, continue, return and exit.

Arrays and Strings: Array declaration, initialization & types of arrays (one-dimensional & two-dimensional),declaring and initializing string variables, Reading strings from terminal, Writing strings to screen, Arithmetic operations on characters, Putting strings together, comparison of two strings, String-handling functions, Table of strings.

Course outcomes

At the end of the course the students will be able to:

- Understand the importance of digital design using Verilog.
- Understand the designing of digital circuits using various modelling concepts.
- Understand the basic concepts of C language and write C programs for various mathematical operations.

Text Books:

1. SamirPalnitkar,"VerilogHDL:Aguidetodigitaldesignandsynthesis",Pearsoneducation,secon dedition.
2. Nazeish M Botros, "HDL Programming Fundamental: VHDL and Verilog". 2009 reprint, Dream tech press.
3. E.Balaguruswamy, "Computing Fundamentals, and C Programming",2nd Edition.

Reference Books:

1. DonaldE.Thomas,PhilipR.Moorby,"TheverilogHardwaredescriptionlanguage",Stringer Science+Businessmedia,LLC,Fifthedition.
2. Michael D Ciletti, "Advanced Digital Design with the Verilog HDL", person (prentice Hall), second edition.
3. Padmanabhan, Tripura Sundari, "Design through Verilog HDL."Wieley,2016 or earlier.
4. CyrilP.R., "Fundamentals of HDL",pearson/sanguine2010.
5. Yashavant Kanetkar,"Letus C",18th edition Authenitc guide to" C" programming language

Semester – III Programming in C and Digital Design using Verilog-Practicals

ProgramName	**BScin Electronics**	Semester	**Third Semester**
CourseTitle	**Programming in C and Digital Design using Verilog (Practical)**		
CourseCode:	**FSC443**	No. of Credits	**2**
Formative Assessment Marks	**25**	Summative Assessment Marks	**25**
Note: Minimum of 5 programmes to be written and executed in each section			

Section –A:DigitalDesign Using Verilog

1) Realization of gates using verilog.
2) Simplification of Boolean expressions and realization using verilog.
3) Realize Adder/Subtractor (Full/Half) circuits using Verilog dataflow description.
4) Realize the following code converters using verilog.
   a) Gray to Binary and vice-versa.
   b) Binary to excess 3andvice-versa.
5) To realize 4-bit ALU using verilog.
6) To realize using verilog description: 8:1 multiplexer, 8:3encoder.
7) To realize using Verilog description: 1:8 Demultiaplexer, 3:8decoder.
8) To realize using Verilog description flip flops:
   a) JK-type (b)SR type(c) T-type(d)D-type.
9) To realize counters: Up/down (BCD & Binary)using Verilog description.
10) Modeling of Universal shift registers.

Section-B:Listof C–Programs

1) Programme to perform arithmetic operation (Addition orsubtraction).
2) Programme to read radius of a circle and find area and circumference of circle.
3) Programme to read three numbers and find the biggest of three (using nested-if).
4) Programme to calculate factorial of a given number.
5) Programme to read percentage of marks and to display appropriate message.
6) Programme to check for prime number.
7) Programme to generate n-primes.
8) Programme to find roots of quadratic equation (Demonstration of switch case statement).
9) Programme to read and display matrix elements.
10) Programme to read and display array elements.
11) Find the gross salary of an employee
12) Remove all vowels from a string

Open Elective Course -3.1

Medical Electronics

Program Name	**BSc in Electronics**	Semester	**Third Semester**
Course Title	**Medical Electronics**		
Course Code:	FSC 860	No. of Credits	**3**
Contact hours	**48 Hours**	Duration of Exam	**2 ½ Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Note: This Course is for candidates who have not opted Electronics as one of the Core Courses.

Course Objectives:

This program is intended to incorporate the knowledge of engineering and science to understand the principle of biomedical electronic circuits.

- This will help the students to apply, measure circuit performance, and solve problems in the areas of biomedical signals and thus create an atmosphere to work effectively on multi-disciplinary teams to attain a common goal.

Course Outcome:

- Students get awareness about different medical electronic equipment's.
- Understand the working and advantages of medical equipments.

Contents

Unit 1	10 Hrs

Fundamental Electronics: Amplifiers**,** Frequency response, signal generation. Different types of transducers & their selection for biomedical applications. Electrode theory, selection criteria of electrodes & different types of electrodes Bio electric amplifiers-instrumentation amplifiers isolation amplifiers-chopper stabilized amplifiers.

Unit 2	11 Hrs

Introduction to Bio-medical instruments: Origin of bio-electric signals, active & passive transducer for medical application –Electrocardiography-waveform-standard lead systems, typical ECG amplifier, EEG electrode –frequency bands – recording systems ,EMG basic principle-block diagram of a recorder.

Unit 3	11 Hrs

Medical Imaging: Nature and production of X-rays, Improving X-ray images, Computerized axial tomography, Using ultrasound in medicine, Ultrasound scanning, Magnetic resonance

imaging PET and SPECT Imaging	
Unit 4	16 Hrs
Biomedical Signal Processing: Fundamentals of signal processing, digital image, transforming image, image enhancement, image Segmentation, image compression, image restoration and reconstruction of medical images. Demonstration using MATLAB.	

Reference Books	
1	Biomedical Instrumentation and measurements - L Cromwell, F J Weibell and Eapfeiffer, PHI Publications.

Open Elective Course -3.2

Augmented and Virtual Reality

Program Name	**BSc in Electronics**		Semester	**Third Semester**	
Course Title	**Augmented and Virtual Reality**				
Course Code:	**FSC 870**		No. of Credits	**3**	
Contact hours	**48 Hours**		Duration of SEA/Exam	**2 .30 Hours**	
Formative Assessment Marks		**40**	Summative Assessment Marks	**60**	

Course Objectives:

The students are able

- To understand the basics of virtual reality
- Clearly get the concept of various applications of virtual reality

Course Outcomes (COs):

The course outcome are:

- Identify the application concepts, human Physiology and Perception.
- Understanding visual perception outcomes

Contents

Unit 1	15Hrs

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.

Augmented Reality: Taxonomy, technology and features of augmented reality, difference between AR and VR.

Unit 2	15Hrs

Augmented Reality: Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.

The Geometry of Virtual Worlds &The Physiology of Human Vision: Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR. #Exemplar/ Case Studies Sweeping coverage of eye movements.

Unit 3	15Hrs

Visual Perception & Rendering and Motion & Tracking: Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates #Exemplar/ Case Studies Automatic stitching of panoramas in Virtual Reality. Motion in Real and Virtual Worlds-Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies.

Reference Books	
1	Computing Fundamentals and C Programming - E. Balagurusamy, Tata McGraw-Hill, 2008.
2	Augmented and Virtual Reality - Anand R, Khanna Publishing House, Delhi.
3	How to Solve by Computer - R.G.Dromey, Pearson Education, Inc, Reprint 2009.
4	Let Us C - Yashavant P. Kanetkar, Fifth Edition, Sridhara Publication, India, 2008.

Open Elective Course -3.3

Application of Electronics – II

Program Name	**BSc in Electronics**	Semester	**Third Semester**
Course Title	**Application of Electronics – II**		
Course Code:		No. of Credits	**3**
Contact hours	**48 Hours**	Duration of Exam	**2 ½ Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Note: This Course is for candidates who have not opted Electronics as one of the Core Courses.

Course Objectives:

- Students familiarize with applications of electronics communication instruments.
- Able to understand the concept of EDUSAT, CCTV and ATM.
- Able to understand the functioning of EVMs.

Course Outcomes:

- Students become familiarized with applications of electronics communication instruments.
- Students are able to handle electronic gadgets like CCTV and ATM.
- Students understand the functioning of EVMs.

Contents

Unit 1	12 Hrs

Introduction to advanced communication: Radio: Introduction, block diagram of radio and its working(transmitter and receiver) and applications of Radio, **TV**- Introduction, block diagram of TV and its working, types of TV and applications of TV. **OFC**- introduction, block diagram of OFC, principle of OFC transmission, applications Embedded system - Smart card, SIM card. Mobile- introduction, Block diagram of mobile, working and applications.

Unit 2	12 Hrs

Advanced Electronics: CCTV camera- Introduction working principles of CCTV, types of CCTV, advantages, disadvantages and applications.

ATM- Definition of ATM, block diagram working, features, advantages and disadvantages

Electronic voting Machine (EVM) – Definition, history, block diagram of EVM, parts of EVM-CU, BU, VVPAT, Steps involved in casting of votes in EVM using VVPAT. Advantages And Disadvantages Of EVM

Unit 3	12 Hrs

Applications of satellite and Internet: Introduction**,** Types-remote sensing SAT, Comminication SAT and EDUSAT. Advantages and disadvantages of satellite. **Internet:** Introduction -growth of internet, internet architecture, Modem, Wi-Fi, Blue tooth - principle of operation using block diagram, advantages and applications.

Unit 4	12 Hrs

E-waste management- Introduction, identification, sorting/separation/ dismantling/segregation In E-waste management. Extracting useful metals from E-waste, recycling. Common sources of E-waste, E-wastes produced by communication and Information Technology sector, collection and transportation of E-Waste, precautions for disposing the E-waste, responsibilities of a citizens in managing e-waste, effect of E-waste on environment, impacts of E-waste on human beings. E-waste certification.

Reference Books	
1	*Basic Electronics-Solid State – B L Theraja - S Chand And Company Ltd*

Semester – IV Electronic Communication-I

Program Name	**BScin Electronics**	Semester	**Fourth Semester**
Course Title	**Electronic Communication-I(Theory)**		
Course Code:	**FSD 440**	No. of Credits	**4**
Contact hours	**60Hours**	Duration of SEA/Exam	**2.30hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives:

On completion of the course, Student will be able:

- To understand principle and working of communication system.
- To understand the principle and working of different modulation and demodulation techniques.
- To understand the Principle and working of Antenna, Waveguides, Transmission lines and RADAR
- To understand the basics of Satellite and Optical Fiber communication

Unit I **15Hours**

Introduction: Brief idea of frequency allocation for radio communication system. Electromagnetic communication spectrum, EM band designation and usage. Block diagram of an electronic communication system.

Propagation of EM waves: Introduction, Ground Wave propagation, Sky-wave propagation Space-wave propagation.

Transmission lines: Basic principles, characteristic impedance, losses in transmission lines, standing waves.

Noise: Introduction, Internal noises–Thermal agitation Noise, Shot Noise, Transit-time Noise, External noises-Atmospheric noise, Extra-terrestrial noise, ndustrial noise, signal to noise ratio(S/N),noisefigure

Unit II **15Hours**

Modulation: Introduction, need and types of modulation.

AM: Representation of AM, Theory of AM , frequency spectrum of AM wave, power and current calculation, modulation by several sine waves. AM generation using Modulated transistor amplifiers.

SSB: Introduction, suppression of carrier- Balanced modulator, suppression of unwanted sideband-Filter system,

AM Receiver– Block diagram and working of tuned radio frequency receiver and Super heterodyne receiver and Simple diode detector.

FM and PM: Theory of FM and PM , frequency spectrum of FM, bandwidth, phase modulation, comparison of AM,FM and PM. FM generation using Direct method.

FM Receiver: Block diagram and working of Super-heterodyne receiver, Single slope FM Detector.

Unit III **15Hours**

Antennas: Introduction, EM radiation, resonant and non-resonant antennas, antenna gain and effective radiated power, field intensity, antenna resistance, bandwidth, beam width, polarization, antenna with parabolic reflector. Geometry and properties of parabolic reflector.

Waveguides: Introduction, working principle of rectangular wave guide and circular waveguide.

Satellite Communication: Introduction, Kepler' s Laws, Satellite Orbits, Geostationary Satellites, Attitude control, Station keeping, Antenna Look angles, Satellite classifications, Transponders(c-band). Earth station.

Unit IV **15Hours**

Fiber Optic Communication: Introduction, block diagram, fiber types, cable construction, Light propagation, Optical fiber configuration: Single mode, step index fiber, multi-mode step index fiber, multimode graded index fiber, comparison, acceptance angle and cone, Numerical Aperture,

Fiber losses: Signal degradation in optical fibers, attenuation, scattering losses, radiative losses, absorption losses, core and cladding losses. Construction, working principle and application of LEDs and Laser diodes, PIN diodes and Avalanche-photodiodes.

RADAR: Block diagram and operations, range equation, block diagram and working of CWRADAR. Applications and limitations of RADAR.

Course outcomes:

After studying this course, students will:

- Understand the basic principle and techniques of Analog Communication.
- Understand the Various modulation techniques and its importance in radio communication
- Understand and Analyze various analog continuous wave modulation and demodulation techniques
- Understand various radio wave propagation mechanisms and its applications
- Acquire Basic knowledge about Satellite Communication.

- Understand and characterize different components of an optical fiber communication system.
- Define optical sources and detectors. Describe LED, laser diodes, PIN diodes and photo diodes.
- Understand knowledge about Radar and Radar equations.

Reference Books:

1. GeorgeKennedy,"ElectronicCommunicationSystems,"TMH,4th Edition,1999
2. D. Roddy and J. Coolen, "Electronic Communications", "Pearson Education India, 4th Edition.
3. Tomasi, "Advanced Electronics Communication Systems,"6thEdition, Prentice Hall.
4. William Schweber, "Electronic communication systems, PHI,4th Edition,2002.
5. Dennis Roddy and Coolen, "Satellite Communication,"4th edition, McGrawHill, 2006.
6. B.P.Lathi,"Modern Digital and Analog Communication Systems,"4th e,Oxford University Press
7. Frenzel, "Principles of Electronic communication systems, "3rdEdition, McGrawHill
8. S. Haykin, "Communication Systems,"WileyIndia,2006.

Semester – IV Electronic Communication-I – Practical

Program Name	**BSc in Electronics**	Semester	**Fourth Semester**
Course Title	**Electronic Communication-I Practical)**		
Course Code:	**FSD 443**	No. of Credits	**2**
Formative Assessment Marks	**25**	Summative Assessment Marks	**25**
Note:Minimum of 10 Experiments are to be performed using hardware and simulation.			

List of Experiments

1. Amplitude modulator – determination of modulation index.
2. Amplitude Demodulator - Diode detector- determination of signal frequency
3. RF amplifier - determination of the mid band gain and bandwidth
4. Frequency Modulator - determination of Modulation Index
5. AGC circuit for AM Detector
6. Frequency mixer - determination of output frequency for different input frequencies
7. Class C Tuned Amplifier – frequency response
8. Radiation pattern of LED
9. Frequency Multiplier
10. IF Amplifier–determination of IF from graph
11. FM transmitter and receiver
12. To Study the Pre-Emphasis and De-Emphasis Circuit
13. Study of intensity modulation in optical fiber
14. Frequency response of optical fiber
15. Measurement of Numerical aperture and losses in fibers
16. Gain characteristics of LED in optical fiber
17. Study of receiver characteristics.

Open Elective Course -4.1

Medical Electronics

Program Name	**BSc in Electronics**	Semester	**Fourth Semester**
Course Title	**Medical Electronics**		
Course Code:	FSD 860	No. of Credits	**3**
Contact hours	**48 Hours**	Duration of Exam	**2 ½ Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Note: This Course is for candidates who have not opted Electronics as one of the Core Courses.

Course Objectives:

This program is intended to incorporate the knowledge of engineering and science to understand the principle of biomedical electronic circuits.

- This will help the students to apply, measure circuit performance, and solve problems in the areas of biomedical signals and thus create an atmosphere to work effectively on multi-disciplinary teams to attain a common goal.

Course Outcome:

- Students get awareness about different medical electronic equipment's.
- Understand the working and advantages of medical equipments.

Contents

Unit 1	10 Hrs

Fundamental Electronics: Amplifiers**,** Frequency response, signal generation. Different types of transducers & their selection for biomedical applications. Electrode theory, selection criteria of electrodes & different types of electrodes Bio electric amplifiers-instrumentation amplifiers isolation amplifiers- chopper stabilized amplifiers.

Unit 2	11 Hrs

Introduction to Bio-medical instruments: Origin of bio-electric signals, active & passive transducer for medical application –Electrocardiography-waveform-standard lead systems, typical ECG amplifier, EEG electrode –frequency bands – recording systems ,EMG basic principle-block diagram of a recorder.

Unit 3	11 Hrs

Medical Imaging: Nature and production od X-rays, Improving X-ray images, Computerized axial tomography, Using ultrasound in medicine, Ultrasound scanning, Magnetic resonance imaging PET and SPECT Imaging

Unit 4	16 Hrs

Biomedical Signal Processing: Fundamentals of signal processing, digital image, transforming image, image enhancement, image Segmentation, image compression, image restoration and reconstruction of medical images. Demonstration using MATLAB.

Reference Books	
1	Biomedical Instrumentation and measurements - L Cromwell, F J Weibell and Eapfeiffer, PHI Publications.

Open Elective Course -4.2

Augmented and Virtual Reality

Program Name	**BSc in Electronics**	Semester	**Fourth Semester**
Course Title	**Augmented and Virtual Reality**		
Course Code:	**FSD 870**	No. of Credits	**3**
Contact hours	**48 Hours**	Duration of SEA/Exam	**2 .30 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives:

The students are able

- To understand the basics of virtual reality
- Clearly get the concept of various applications of virtual reality

Course Outcomes (COs):

The course outcome are:

- Identify the application concepts, human Physiology and Perception.
- Understanding visual perception outcomes

Contents

Unit 1	15Hrs

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.

Augmented Reality: Taxonomy, technology and features of augmented reality, difference between AR and VR.

Unit 2	15Hrs

Augmented Reality: Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.

The Geometry of Virtual Worlds &The Physiology of Human Vision: Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR. #Exemplar/ Case Studies Sweeping coverage of eye movements.

Unit 3	15Hrs

Visual Perception & Rendering and Motion & Tracking: Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates #Exemplar/ Case Studies Automatic stitching of panoramas in Virtual Reality. Motion in Real and Virtual Worlds-Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies.

Reference Books	
1	Computing Fundamentals and C Programming - E. Balagurusamy, Tata McGraw-Hill, 2008.
2	Augmented and Virtual Reality - Anand R, Khanna Publishing House, Delhi.
3	How to Solve by Computer - R.G.Dromey, Pearson Education, Inc, Reprint 2009.
4	Let Us C - Yashavant P. Kanetkar, Fifth Edition, Sridhara Publication, India, 2008.

Open Elective Course -4.3

Application of Electronics – II

Program Name	**BSc in Electronics**	Semester	**Fourth Semester**
Course Title	**Application of Electronics – II**		
Course Code:		No. of Credits	**3**
Contact hours	**48 Hours**	Duration of Exam	**2 ½ Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Note: This Course is for candidates who have not opted Electronics as one of the Core Courses.

Course Objectives:

- Students familiarize with applications of electronics communication instruments.
- Able to understand the concept of EDUSAT, CCTV and ATM.
- Able to understand the functioning of EVMs.

Course Outcomes:

- Students become familiarized with applications of electronics communication instruments.
- Students are able to handle electronic gadgets like CCTV and ATM.
- Students understand the functioning of EVMs.

Contents

Unit 1	12 Hrs

Introduction to advanced communication: Radio: Introduction, block diagram of radio and its working(transmitter and receiver) and applications of Radio,

TV- Introduction, block diagram of TV and its working, types of TV and applications of TV.

OFC- introduction, block diagram of OFC, principle of OFC transmission, applications Embedded system - Smart card, SIM card.

Mobile- introduction, Block diagram of mobile, working and applications.

Unit 2	12 Hrs

Advanced Electronics: CCTV camera- Introduction working principles of CCTV, types of CCTV, advantages, disadvantages and applications.

ATM- Definition of ATM, block diagram working, features, advantages and disadvantages

Electronic voting Machine (EVM) – Definition, history, block diagram of EVM, parts of EVM-CU, BU, VVPAT, Steps involved in casting of votes in EVM using VVPAT. Advantages And Disadvantages Of EVM

Unit 3	12 Hrs
Applications of satellite and Internet: Introduction**,** Types-remote sensing SAT, Comminication SAT and EDUSAT. Advantages and disadvantages of satellite. **Internet:** Introduction -growth of internet, internet architecture, Modem, Wi-Fi, Blue tooth - principle of operation using block diagram, advantages and applications.	
Unit 4	12 Hrs
E-waste management- Introduction, identification, sorting/separation/ dismantling/segregation in E-waste management. Extracting useful metals from E-waste, recycling. Common sources of E-waste, E-wastes produced by communication and Information Technology sector, collection and transportation of E-Waste, precautions for disposing the E-waste, responsibilities of a citizens in managing e-waste, effect of E-waste on environment, impacts of E-waste on human beings. E-waste certification.	

Reference Books	
1	*Basic Electronics-Solid State – B L Theraja - S Chand And Company Ltd*