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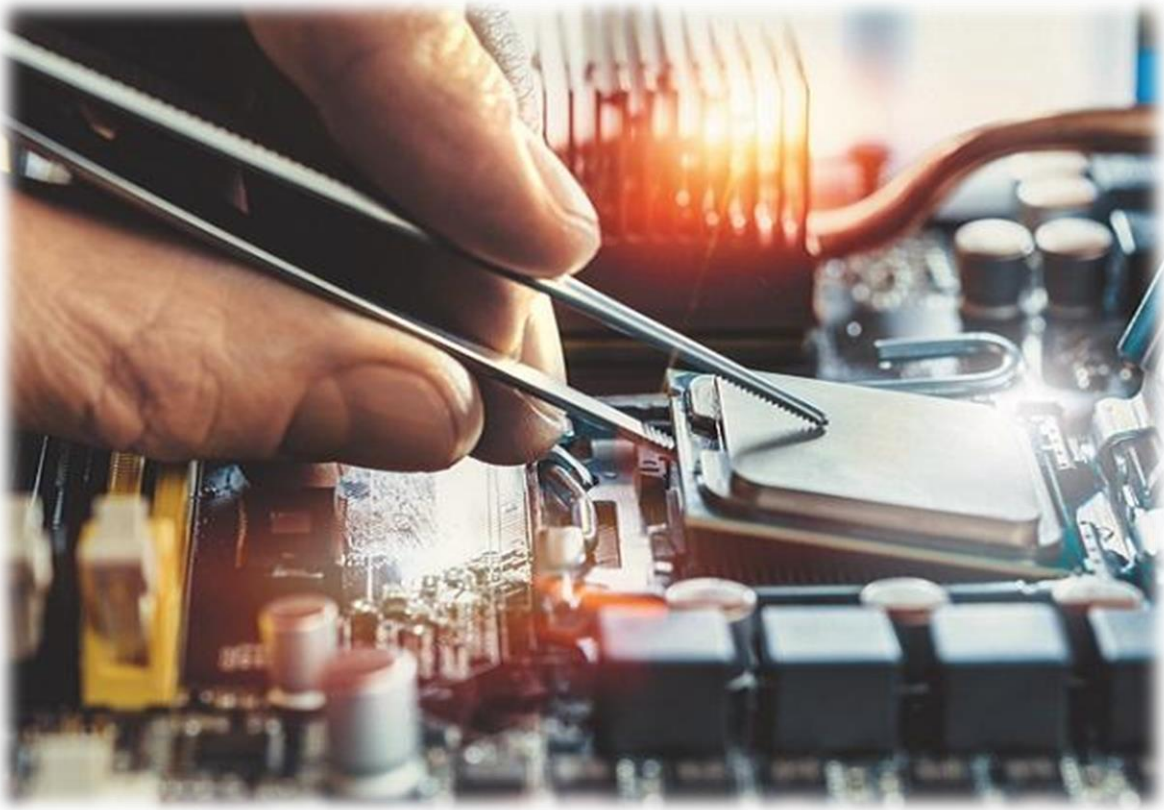
Curriculum Framework for Four-Year Undergraduate Multidisciplinary Programme (Honours) & Master Programme in Colleges and Universities of Karnataka State Under NEP 2020.



3rd and 4th Semesters Model Syllabus for BSc. in Electronics

Submitted to
Vice Chairman
Karnataka State Higher Education Council
30, Prasanna Kumar Block, Bengaluru City University Campus,
Bengaluru, Karnataka – 560009

Composition of Subject Expert Committee Members

SN	Name & Organization	Designation
1	Dr. S. V. Halase, Vice Chancellor, Davanagere University, Davanagere.	Chairman
2	Dr. Mahadev Prasad M Professor, University of Mysore, Mysuru.	Member
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Special Invitees	
1	Dr. Nagesh
2	Dr. Anil Kumar Chikmanur
3	Dr. Manjesh,

Model Curriculum

of

BSc Honours

in

Electronics

3rd & 4th Semesters

Karnataka State Higher Education Council

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Model Curriculum

Program Name	**BSc in Electronics**	Semester	**Third Semester**
Course Title	**Programming in C and Digital Design using Verilog (Theory)**		
Course Code:	**ELE CT3.1**	No. of Credits	**4**
Contact hours	**60 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives: After the successful completion of the course, the student will be able to:

- The ability to code and simulate any digital function in Verilog HDL.
- Know the difference between synthesizable and non-synthesizable code.
- Understand library modelling, behavioural code and the differences between simulator algorithms and logic verification using Verilog simulation.
- Learn good coding techniques required for current industrial practices.
- Gain the knowledge of programming the system using C programming language.

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1. Apply the acquired knowledge of digital circuits in different levels of modelling using Verilog HDL.
CO2. Apply the acquired knowledge of digital circuits in different levels of modelling using Verilog HDL.
CO3. Design and verify the functionality of digital circuit/system using test benches.
CO4. Develop the programs more effectively using directives, Verilog tasks and constructs.
CO5. Design and analyse algorithms for solving simple problems.
CO6. Write and execute and debug C codes for solving problems.

Contents	**60Hrs**
Unit–1:	15 Hrs

C Programming: Introduction, Importance of C, Character set, Tokens, keywords, identifier, constants, basic data types, variables: declaration & assigning values. Structure of C program

Arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, bitwise operators, expressions and evaluation of expressions, type cast operator, implicit conversions, precedence of operators.

Arrays: Basics of arrays, declaration, accessing elements, storing elements, two-dimensional and multi-dimensional arrays. Input output statement – sprintf(), scanf() and getch(), and library functions (math and string related functions).

Unit -2:	15 Hrs

Decision making, branching, and looping: if, if-else, else-if, switch statement, break, for loop, while loop and do loop.

Functions: Defining functions, function arguments and passing, returning values from functions, example programs.

Pointers: Pointer declaration, assigning values to pointers, pointer arithmetic, array names used as pointers, pointers used as arrays, pointers and text strings, pointers as function parameters.

Structures: Structure type declarations, structure declarations, referencing structure members, referencing whole structures, initialization of structures, structure bit fields

Unit -3:	15 Hrs

Overview of Verilog HDL: Evolution of CAD, emergence of HDLs, typical HDL flow, Trends in HDLs.

Hierarchical Modelling Concepts: Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block, Lexical conventions. Data types, system tasks, compiler directives.

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

Gate-Level Modelling: Modelling using basic Verilog gate primitives, Description of and/or and buf/not type gates, Rise, fall and turn-off delays, min, max, and typical delays. Combinational logic circuit design using Gate level modelling

Unit -4:	15 Hrs

Dataflow Modelling: Continuous assignments, delay specification, expressions, operators, operands, operator types.

Behavioral Modelling: Structured procedures, initial and always, blocking and non-blocking statements. Delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks.

Tasks and functions: Differences between tasks and functions, declaration, invocation, automatic tasks and functions. Combinational and sequential logic circuit design using all three modelling

References	
1	Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis," 2nd Edition, Prentice Hall PTR, 2006.
2	E. Balagurusamy, "Programming in ANSI C", 4th Edition, Tata McGraw-Hill, 2008.
3	Donald E. Thomas, Philip R. Moorby, "The Verilog Hardware Description Language", 5th Edition, Springer, 2002.
4	Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL", 2nd Edition, Pearson Education, 2010.
5	Padmanabhan, Tripura Sundari, "Design through Verilog HDL", Wiley Eastern, 2016.
6	Nazeih M. Botors, "HDL Programming VHDL and Verilog", 1st Edition, Dreamtech Publication, New Delhi, 2006.
7	Yashavant P. Kanetkar, "Let us C", 18th Edition, BPB Publications, 2021.
8	T Jeyapoovan, "A First Course in Programming with C," Vikas Publishing Pvt LTD, 2004.
9	Kevin Skahill, "VHDL for Programmable Logic,"Pearson Education, 2006.
10	Cyril P R, "Fundamentals of HDL Design," Pearson, 2010.

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Model Curriculum

Program Name	**BSc in Electronics**	Semester	**Third Semester**
Course Title	**Programming in C and Digital Design using Verilog (Practical)**		
Course Code:	**ELE CP3.1**	No. of Credits	**2**
Formative Assessment Marks	**25**	Summative Assessment Marks	**25**
Note: Minimum of 10 programmes to be written and executed in each section			

Part -A: Programming in C Laboratory

Write and execute C Program to

1. Find the area and circumference of a circle
2. Find the biggest and smallest elements in a series
3. Find the factorial of a given number
4. Check the prime number in a series
5. Find the roots of quadratic equation
6. Find the gross salary of an employee
7. Remove all vowels from a string
8. Upper case and lower-case conversion and vice-versa
9. Reverse a string using library functions
10. Reverse a string without using library
11. Check whether the string is palindrome or not
12. Arrange the array in ascending and descending order using bubble sort
13. To perform arithmetic operations for a matrix.
14. Display prime numbers between intervals 0 to 100
15. Find GCD of two numbers.

Part – B: Verilog HDL Laboratory

Write and execute Verilog code to realize

1. Realization of logic gates.
2. Encoder without priority and with priority.
3. Multiplexer, De-multiplexer.
4. Comparator, Code converters – Binary to Gray and vice versa.
5. Adder/Subtractor (Half and Full) using different modelling styles.
6. 4-bit parallel adder and 4-bit ALU/8-bit ALU.
7. SR, D, JK, T-flip-flops.
8. To realize counters: Up/Down (BCD and Binary).
9. 4-bit Binary counter, BCD counters (Synchronous reset) and any arbitrary sequence counters.
10. 4-bit Binary counter, BCD counters (Asynchronous reset) and any arbitrary sequence counters.
11. Modelling of Universal shift registers.

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Model Curriculum

Program Name	**BSc in Electronics**	Semester	**Third Semester**
Course Title	**Fundamentals of Electronics. (Theory)**	Course Code:	**ELE OE 3.1**
Contact hours	**45 Hours**	No. of Credits	**3**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**
OE Paper is to be offered for the Students other than Science stream			

Theory Contents	
Unit–1:	15 Hrs
Passive Components: Overview of passive components-Fabrication, Types, colour coding, and applications. **Transformer**: Principle, construction and working, turn ratio, Types of transformers (Step up and Step down). **Semiconductors**: Intrinsic and extrinsic semiconductors. **Diodes**: P-N Junction theory, V-I Characteristics, Rectifiers, Clippers, and Clampers (Qualitative analysis only). **Special diodes**: Zener diode, LED and LDR; Construction, working and applications.	
Unit -2:	15 Hrs
Bipolar Junction Transistor (BJT): Physical structures, modes of operations, characteristics. Transistor as an amplifier, RC- Coupled amplifier, Darlington pairs, Transistor as a switch. **Field Effect Transistor (FET):** Physical structures and modes of operations, Characteristics. **Electronic Instruments**: Ammeter, Voltmeter- design and construction, analog millimeter, Digital millimeter, function generator (Qualitative analysis only). Cathode Ray Tube (CRT), Cathode Ray Oscilloscope (CRO)- Block diagram. **Digital fundamentals:** Binary numbers, signed binary numbers, binary to decimal and Decimal to Binary conversion, Binary additions, and Subtractions, Logic gates: AND, OR and NOT gates.	
Unit -3:	15 Hrs
Component and Device Applications: To design and Construct at least Ten of the following circuits.	

1. V –I characteristics of semiconductor diode.
2. V –I characteristics of Zener diode. Determination of breakdown voltage.
3. V –I characteristics of LED. Determination of Cut-in voltage.
4. Characteristics of LDR.
5. Half wave rectifier; with and without filter. Determination of ripple factor.
6. Full wave rectifier (Centre tap/ Bridge); With and without filter, determination of ripple factor.
7. Zener diode voltage regulator; determination of line and load regulation.
8. Clipping circuits; Positive clipper, Negative Clipper, Biased positive and negative clippers. Trace the input and output waveforms.
9. Clamper circuits: Positive clamper, Negative Clamper. Trace the input and output waveforms.
10. Input and output characteristics of a transistor in Common Emitter configuration, determine of current gain β.
11. Input and output characteristics of a transistor in common base configuration, determine the current gain α.
12. Transistor as a switch.
13. Construct RC coupled amplifier. Plot the frequency response curve and determine the bandwidth.
14. V-I Characteristics of Common Source (CS) configuration of FET. Determine the current gain.
15. Construct an ammeter to read (0-1ma) of current.
16. Construct a voltmeter to read (0-1volt).
17. Measure Vp, Vpp and Time period of Sine and Square waves using CRO.
18. Construct OR, AND and NOT gates using diodes and transistors. Verify the truth tables.
19. Verify the truth tables OR, AND and NOT gates using Integrated Chips (ICs).
20. Construct four-bit binary adder.

References	
1	"A Textbook of Electronics" R. S. Sedha; S Chand and Co, 3rd edition.
2	"Principles of Electronics", V K Mehta and Rohit Mehta, S Chand and Co
3	"Basic Electronics", B L Theraja, S Chand and Co, 3rd edition 2012
4	"Electronic Devices", Devid Bell, Reston Publishing Company.
5	"Electronic Devices and Circuit Theory", Pearson edition.
6	"Digital Principles and Applications", Malvino and Leach
7	"Electronics text lab manual", Paul B Zabar

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Model Curriculum

Program Name	**BSc in Electronics**	Semester	**Third Semester**
Course Title	**Application of Electronics-1 (Theory)**	No. of Credits	**3**
Course Code:	**ELE OE 3.2**	Contact hours	**45 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**
OE Paper is to be offered for the Students other than Science stream			

Theory Contents	
Unit–1: Basic Electronics	12 Hrs
Introduction to circuit components- Resistors, capacitors, inductor, transformer, diode and transistor. Symbols, pimples. LED and LCD display, relay, fuse, switches, wires. AC and DC applications.	
Unit -2: Applied Electronics	13 Hrs
Electronic instruments: DMM, CRO, Biomedical instruments-ECG, EEG, EMG, pH meter, X-ray, sphygmomanometer, Glucometer, Digital thermometer. Sensor-OMR, MICR, Scanner, Barcode reader.	
Unit -3: Power Supplies	10 Hrs
Dc power supply, Rectifiers-principle, Types Inverter and UPS. Adopter and SMPS. Inverter and UPS. Mobile chargers.	
Unit -4: Electronic calculators	10 Hrs
Types, Functions of Basic calculators-block diagram, Keypad using, use of calculator.	

References	
1	Basic Electronics-Solid State – B L Theraja - S Chand And Company Ltd
2	Electronic Devices And Circuit Theory – Robert L Boylestad And Louis Nashelsky (PHI)

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Model Curriculum

Program Name	**BSc in Electronics**	Semester	**Third Semester**
Course Title	**Robotics. (Theory)**	No. of Credits	**3**
Course Code:	**ELE OE3.3**	Contact hours	**45 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**
OE Paper is to be offered for the Students other than Electronics stream			

Theory Contents	
Unit–1:	15 Hrs
Definitions of Robots, Robotics, Motivation, A Brief History of Robotics, A Robot System, Interdisciplinary Areas in Robots, Classification of Robots, Introduction to embedded system, Understanding Embedded System, Overview of basic electronics and digital electronics. Microcontroller vs. Microprocessor, Common features of Microcontroller. Comparison between the two Different types of microcontrollers. Sensors, Classification of sensors (contact & non-contact), characteristics of sensors, Touch sensor, Position sensor, optical sensor, IR, PIR, Ultrasonic, temperature, displacement sensor.	
Unit -2:	15 Hrs
Getting Started with Programming platform of Robots: Installation of IDE, Pin configuration and architecture of Microcontroller (Atmel series/arduino), Device and platform features. Concept of digital and analog ports. Familiarizing with Interfacing Board, Introduction to Embedded C platform, Review of Basic Concepts, Arduino data types, Variables and constants, Operators, Control Statements, Arrays Functions, I/o Functions, Pins Configured as INPUT, Pins Configured as OUTPUT, Incorporating timedelay() function, delayMicroseconds() function ,millis() function , micros() function	
Unit -3:	15 Hrs
Programming different types of Robots: 1. Temperature & Humidity controlled Robot (Fan Regulation, thermostat) 2. Infra-Red signal Controlled Robot (Measuring the speed of the vehicle) 3. Ultra-sonic signal operated Robot (automatic Tap system/Hand Drier/Floor drier) 4. Obstacle Follower & avoider Robot	

References	
1	Fundamentals of Robotics by D K Pratihar
2	Robotics Simplified: An Illustrative Guide to Learn Fundamentals of Robotics,by Dr. Jisu Elsa Jacob , Manjunath N
3	Introduction to Robotics | Fourth Edition by John Craig
4	Arduino Robotics by John-David Warren (Author), Josh Adamsduino
5	Programming in 24 Hours by Richard Blum
6	Getting Started with Arduino: The Open Source Electronics Prototyping Platform Book by Massimo Banzi and Michael Shiloh

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Program Name	**BSc in Electronics**	Semester	**Third Semester**
Course Title	**Medical Electronics. (Theory)**	No. of Credits	**3**
Course Code:	**ELE OE 3.4**	Contact hours	**45 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**
OE Paper is to be offered for the Students other than Electronics stream			

Theory Contents	
Unit–1:	10Hrs
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	
Unit -2:	12 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, recording systems, EMG basic principle-block diagram of a recorder.	
Unit -3:	10 Hrs
Medical Imaging: Nature and production od X-rays, Improving X-ray images, Computerised axial tomography, Using ultrasound in medicine, Ultrasound scanning, Magnetic resonance imaging PET and SPECT Imaging	
Unit -4:	13Hrs
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	

References	
1	L Cromwell, F J Weibell, Eapfeiffer, Biomedical Instrumentation and measurements, PHI Publications.

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Model Curriculum

Program Name	**BSc in Electronics**	Semester	**Fourth Semester**
Course Title	**Electronic Communication-I (Theory)**		
Course Code:	**ELE CT 4.1**	No. of Credits	**4**
Contact hours	**60 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives:

- To understand the communication system, Principle and working communication system, means and medium of communication.
- To understand the Principle and working of different modulation techniques.
- Will be able to differentiate between analog and digital communication.
- To understand the Principle and working of Satellite and optical fibre communication.

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1. Know the basic concept of Analog Communication, means and medium of communication.

CO2. Understand the principle of Analog and digital modulation.

CO3. Familiar with "AM" and "FM "techniques.

CO4. Understand the basic concept of Pulse Modulation, Carrier Modulation for digital transmission and able to construct simple pulse modulation.

CO5. Understand the basic concept of Satellite Communication

CO6. Understand the basic concept of Optical Fibre Communication

Contents	**60Hrs**
Unit–1:	15 Hrs

Electronic communication: Introduction to communication – means and modes. Need for modulation. Block diagram of an electronic communication system. Brief idea of frequency allocation for radio communication system in India (TRAI). Electromagnetic communication spectrum, band designations and usage. Channels and base-band signals. Concept of Noise, signal-to-noise (S/N) ratio.

Propagation of "EM" Wave: Introduction, Loss of "EM" Energy due to noise, Ground Wave, Sky-wave and Space-wave propagation. Ionosphere and its effects.

Communication medium: Transmission lines, coaxial cables, wave guides and optical fibres.

Antenna: Introduction, Antenna parameters, Ferrite rod antenna, yagi-Uda antenna, Dish-antenna, principle, Working and applications only

Unit -2:	15 Hrs

Analog Modulation: Amplitude Modulation, modulation index and frequency spectrum. Generation of AM (Emitter Modulation), Amplitude Demodulation (diode detector), Concept of Single side band generation and detection. Frequency Modulation (FM) and Phase Modulation (PM), modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM using VCO, FM detector (slope detector), Qualitative idea of Super heterodyne receiver.

Analog Pulse Modulation: Channel capacity, sampling theorem, Basic Principles- PAM, PWM, PPM, modulation and detection technique for PAM only, Multiplexing

Unit -3:	15 Hrs

Digital Pulse Modulation: Need for digital transmission, Pulse Code Modulation, Digital Carrier Modulation Techniques.

Introduction to Communication and Navigation systems: Satellite Communication Introduction, need, geosynchronous satellite orbits, geostationary satellite advantages of geostationary satellites. Satellite visibility, transponders (C - Band), path loss, ground station, simplified block diagram of earth station. Uplink and downlink.

Unit -4:	15 Hrs

Optical Fiber Communication: Optical Fibers: Structure and wave guides, fundamentals, Nature of light, basic optical laws and definitions, optical fiber types, Rays and modes, ray optics. Signal degradation in optical fibers, attenuation, scattering losses, radiative losses, absorption losses, core and cladding losses, signal distortion in optical wave guides, group delay, dispersion, pulse broadening in graded index wave guide.

Optical sources: LEDs, structure, source materials, Laser diodes: Structures, threshold conditions, modal properties and radiation patterns

Optical Receiver Operations: Fundamental receiver operations, digital signal transmission, receiver noise, analog receivers.

References	
1	Electronic Communications, D. Roddy and J. Coolen, Pearson Education India.
2	Advanced Electronics Communication Systems- Tomasi, 6th edition, Prentice Hall.
3	Modern Digital and Analog Communication Systems, B.P. Lathi, 4th Edition, 2011, Oxford University Press.
4	K.D Prasad, "Antenna and Wave Propagation", Satyaprakashan, New Delhi.
5	Sanjeev Gupta, "Electronic Communication Systems", Khanna Publishers, New Delhi.
6	Electronic Communication systems, G. Kennedy, 3rd Edn., 1999, Tata McGraw Hill.
7	Principles of Electronic communication systems – Frenzel, 3rd edition, McGraw Hill
8	Communication Systems, S. Haykin, 2006, Wiley India Electronic Communication system, Blake, Cengage, 5th edition.
9	Wireless communications, Andrea Goldsmith, 2015, Cambridge University Press
10	Gerd Keiser, "Optical Fibre Communication ", McGraw Hill, 3rd Edn.

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Model Curriculum

Program Name	**BSc in Electronics**	Semester	**Fourth Semester**
Course Title	**Electronic Communication-I (Practical)**		
Course Code:	**ELE CP 4.1**	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.	Construct amplitude modulator using transistor / I. C. Determination the modulation index.
2.	Construct frequency modulator circuit – determine the modulation index.
3.	"AM" Liner Diode detector- trace the input and output waveforms.
4.	Frequency mixer circuit – Verify output frequency for different input frequencies.
5.	"FM" Detector – Plot the frequency response curve.
6.	Study of Balanced demodulator
7.	Study of IF amplifier circuit.
8.	Pulse amplitude modulation (PAM) – trace the output waveforms.
9.	Pulse width modulation (PWM) – trace the output waveforms.
10.	Pulse position modulation (PPM) – trace the output waveforms.
11.	Characteristics of LED in OFC
12.	Study of Numerical aperture
13.	Study of OFC losses.
14.	Setting up simple OFC Link.

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Model Curriculum

Program Name	**BSc in Electronics**	Semester	**Fourth Semester**
Course Title	**Application of Electronics-2 (Theory)**	No. of Credits	**3**
Course Code:	**ELE OE 4.1**	Contact hours	**45 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**
OE Paper is to be offered for the Students other than Science stream			

Theory Contents	
Unit–1: Introduction to Advanced Communication	12 Hrs
Radio, TV- principles, block diagram & applications OFC applications and advantages, Embedded system – Smart card, SIM card Mobiles- Bock diagram &applications	
Unit -2: Advance Electronics	12 Hrs
CCTV camera, ATM- principles, block diagram & applications Electronic voting Machine (EVM)- CU,BU,VVPAT.,	
Unit -3: Application of Satellite	11 Hrs
Types, EDUSAT, TV & Internet-modem, Wi-Fi.	
Unit -4: E-waste management	10 Hrs
E-waste management-identification, segregation, disposal	

References	
1	Basic Electronics-Solid State – B L Theraja - S Chand And Company Ltd

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Model Curriculum

Program Name	**BSc in Electronics**	Semester	**Fourth Semester**
Course Title	**Augmented and Virtual Reality (Theory)**	No. of Credits	**3**
Course Code:	**ELE OE 4.2**	Contact hours	**45 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**
OE Paper is to be offered for the Students other than Electronics stream			

Theory Contents	
Unit–1: Introduction to Virtual Reality	10Hrs
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.	
Unit -2: Augmented Reality	10 Hrs
AR: Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.	
Unit -3: The Geometry of Virtual Worlds &The Physiology of Human Vision	12 Hrs
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 -4: Visual Perception & Rendering and Motion & Tracking	13 Hrs
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.	

References	
1	E. Balagurusamy, - Computing Fundamentals and C Programming‖, Tata McGraw-Hill, 2008.
2	Anand R., “Augmented and Virtual Reality”, Khanna Publishing House, Delhi.

References	
3	R.G.Dromey, How to Solve by Computer, Pearson Education, Inc, Reprint 2009.
4	Yashavant P. Kanetkar, ―Let Us C, Fifth Edition, Sridhara Publication, India, 2008.

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Program Name	**BSc in Electronics**	Semester	**Fourth Semester**
Course Title	**IOT and Applications (Theory)**	No. of Credits	**3**
Course Code:	**ELE OE 4.3**	Contact hours	**45 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**
OE Paper is to be offered for the Students other than Electronics stream			

Theory Contents	
Unit–1:	12 Hrs
Fundamentals of IoT: Introduction, History of IoT, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, Components of an IoT Solution, IoT frameworks, IoT and M2M, Open Source and Commercial Examples, Competing Standards for IoT	
Unit -2:	12 Hrs
Sensors Networks: Definition, Traditional Data Storage, Analog and Digital I/O Basics, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.	
Unit -3:	11 Hrs
Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus. IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT. Edge connectivity and protocols	
Unit -4:	10 Hrs
Data Handling& Analytics: Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage Applications of IoT: Home Automation	

References	
1	Internet of Things, Vasudevan, Nagrajanand and Sundaram, Wiley India.
2	Srinivasa K G “Internet of Things”, Cengage Learning, India 2017.

References	
3	David Hanes, Gonzalo Salgueiro, Patrick Grosstete, Robert Barton, Jerome Henry, IoT fundamentals: Networking Technologies, Protocols and uses cases for the Internet of things, 1st Edition, Pearson Education.
4	Iot Fundamentals, David Hence et al, Cisco press.