BANGALORE UNIVERSITY

CURRICULUM FOR B Sc DEGREE & B Sc HONS. (ELECTRONICS)

(*According to NEP – 2020 Regulations*)

SUBJECT: ELECTRONICS

(2022 – 23 *Onwards)*

BANGALORE UNIVERSITY
Department of Electronic Science
Jnana Bharathi, Bangalore – 560056

September, 2022

CONTENTS

PROCEEDINGS OF BOS MEETING

Meetings of BoS UG was convened at the Chairman's Chamber, Department of Electronic Science, Bangalore – 560060 to frame the syllabus for B.Sc. 3rd and 4th semester Electronic Course under the New Education Policy (NEP)-2020. The committee convened *i.e.,* on 13.09.2022 and exhaustive discussion were made. Finally, it was decided to adopt the syllabus framed by the expert committee for 3rd and 4th semesters of the B Sc Electronics Course as per the State Government of Karnataka, the core committee framed the course syllabus through Department of Higher Education Council (DHEC), Government of Karnataka with minor modifications.

The following members were present. (*The opinion and approval of the outstation members was received through e-mail*).

Sl No.	Name	Designation	Signature
1.	Mrs Gayatri Sudhir Professor & Vice Principal, Department of Electronics, Oxford college of Arts, Science and Commerce, HSR Layout, Bangalore	Member (UG)	
2.	Mr Benny Sebastin Associate Professor, Department of Electronics, Christ University, Bangalore	Member (UG)	
3.	Dr Subramanya Bhat M Associate Professor, Department of Electronics, Vijaya College, RV road, Bangalore	Member (UG)	
4.	Dr Manjesh Professor Department of Electronic Science, Bangalore University, Bengaluru – 56056	Chairman (UG)	

The Board placed a record of the appreciation for the members of the previous BOS members for their contributions to the academics of the department. The Chairman extended warm welcome to the constituted members of the BOS and thanked for the acceptance of the invitation with short notice.

The main agenda of the meeting i.e., framing of syllabus for the B Sc 3rd and 4th semester degree in Electronics under NEP was taken for discussion. After thorough discussions the following resolutions were made.

The following Resolutions were made:

1. The committee unanimously agreed to adopt the structure (*appendix – 1*) suggested by the Karnataka State Higher Education Council (KSHEC) under NEP program and also to consider the proposed curriculum for the 3rd and 4th semesters UG program in Electronics (a*ppendix -2*) with effect from 2022- 23

2. Minor changes in the curriculum were made related to the teaching hours for theory & practical classes, maximum marks for the papers and minimum marks for passing, credits to the respective papers, etc.

3. ***Eligibility criteria for Admission to the B Sc Electronics***: Students who have qualified PUC/ 10+2 /ITI or equivalent are eligible for opting Electronics in UG program.

4. Diploma in Electronics / Electrical / Medical Electronics / Computer Science / Telecommunications or equivalent are eligible for lateral entry to III semester.

5. The board discussed about the option for the candidates to choose the open elective paper. After elaborate discussions it was unanimously decided that open elective may be given to all students including the candidates opted electronics as major subject.

6. The Scheme for awarding internal assessment for the students was discussed and approved.

7. It was resolved that number of students for practical shall be 10 (Ten) per batch per teacher.

Finally, the Chairman extended vote of thanks to all BOS members for their presence.

Preamble

This model curriculum content for B Sc (Honours) Electronics as per NEP – 2020, is intended to enable the graduates to respond to the current needs of the industry and equip them with skills relevant for national and global standards. The framework encourages innovation in teaching-learning process and appropriate assessment of student learning levels.

Introduction

B Sc (Honours) Electronics is a program which needs to develop a specialized skill set among the graduates to cater to the need of industries.

The curriculum is designed to help the learners to analyze, appreciate, understand and critically engage with learning of the subject and also to provide better learning experience to the graduates. Apart from imparting disciplinary knowledge, the curriculum is aimed to equip the graduates with competencies like problem solving and analytical reasoning which provide them high professional competence.

The Department/Institute/University is expected to encourage its faculty concerned to make suitable pedagogical innovations, in addition to teaching/learning processes suggested in the model curriculum, so that the Course/Program learning outcomes can be achieved.

Significance

In recent years, Electronics has made unprecedented growth in terms of new technologies, new ideasand principles. The research organizations and industries that work in this frontier area are in need of highly skilled and scientifically oriented manpower. This manpower can be available only with flexible, adaptive and progressive training programs and a cohesive interaction among the institutions, universities, and industries. The key areas of study within subject area of Electronics comprise of Semiconductor Devices, Power Electronics and Motor rives, Analog and Digital Circuit design, Microprocessors & Microcontroller Systems, Computer Coding/ Programming in high level languages etc. and also modern applied fields such as Embedded Systems, Data Communication, Robotics, Control Systems, Nano Electronics and Nano Electronic Devices etc.

Eligibility criteria

Students who have qualified PUC/ 10+2 /ITI or equivalent are eligible for opting Electronics in UG program.

Program Objectives

The overall Objectives of the B.Sc. (Degree) / B.Sc. (Honours) Electronics program are to:

- Provide students with learning experiences that develop broad knowledge and understanding of key concepts of electronics and equip students with advanced scientific / technological capabilities for analyzing and tackling the issues and problems in the field of electronics.

- Develop ability in students to apply knowledge and skills they have acquired to solve specific theoretical and applied problems in electronics.
- Develop abilities in students to design and develop innovative solutions for benefits of society.

- Provide students with skills that enable them to get employment in industries or pursue higher studies or research assignments or turn as entrepreneurs.

Program Outcome

- Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research.

- To acquire experimental skills, analyzing the results and interpret data.

- Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.

- Capacity to identify and implementation of the formulate to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.

- Capability to use the Modern Tools / Techniques.

Tentative Course Structure
(Major Discipline: ELECTRONICS) - Semesters 1 – 10

SEMESTER	Discipline Core (DSC)	Major : Discipline Core (DSC)	OE / DSE
Semester 1	DSC 1	Electronic Devices and Circuits	OE 1: Domestic Equipment Maintenance OE 2: Renewable Energy and Energy Harvesting OE 3: Basics of Electronics, Computers and PCB Design
Semester 2	DSC 2	Analog and Digital Electronics	OE 2.1: Consumer Electronics OE 2.2: Industrial Electronics OE 2.3: C Programming and interfacing with Arduino OE 2.4: Mobile communication OE 2.5: Mobile Application Programming
Semester 3	DSC 3	Programming in C and Digital Design Using Verilog	OE 3.1. E-Business . OE 3.2. Application of Electronics-1 OE 3.3. Robotics OE 3.4. Medical Electronics
Semester 4	DSC 4	Electronic Communications – 1	OE 4.1. Application of Electronics -2 OE 4.2. E-Commerce OE 4.3. IOT and Applications
Semester 5	DSC 5 DSC 6	Microcontroller 8051 and PIC Communication – II	DSE 1: Computer Organization DSE 2: RFID Technology DSE 3: Photonics
Semester 6	DSC 7 DSC 8	Power Electronics, Sensors, PLCs, Transducers, and Instrumentation IOT and 5G communications	DSE 4: Cryptography DSE 5: Control Systems DSE 6: Project work (0+1+2)
Semester 7	DSC 9 DSC 10 DSC 11	Signals and Systems Embedded Systems Microwave Communications	DSE 7: Wireless communication DSE 8: Python Programming DSE 9: Mechatronics
Semester 8	DSC 12 DSC 13 DSC14	Digital Signal Processing VLSI Designing Image Processing	DSE 10: ARM Processor DSE 11: Computer Network DSE 12: AI, ML and Python Research Project

Proposed Curriculum Framework for Multidisciplinary Four - Year Undergraduate Programme/ Five-year Integrated Master's Degree Programme

YEAR	OBJECTIVES	NATURE OF COURSES	OUTCOME	NO. OF COURSES
1st year – (1st & 2nd Semesters)	Understanding and	1. Major Core Courses 2. Minor/Related Discipline 3. Languages 4. Ability Enhancement Compulsory Courses 5. Skill Enhancement/Development Courses	 Understanding of Disciplines Language Competency Gaining perspective of context/Generic skills Basic skills sets to pursue any	1+1 1+1 2+2 1+1 1+1
EXIT OPTION WITH CERTIFICATION				
2nd Year – (3rd & 4th Semesters)	Focus and Immersion	1. Major Core Courses 2. Minor/ Related Discipline 3. Ability Enhancement 4. Skill based Vocational 5. Extra-curricular Activities	Understanding of disciplines Gaining perspective of context Skill sets to pursue vocation Development of various Domains of mind &Personality	2+2 1+1 1+1 1+1 1+1
EXIT OPTION WITH DIPLOMA				
3rd Year – (5th & 6th Semesters)	Real time Learning	1. Major Discipline Core and Elective Courses 2. Minor Discipline / Generic or Vocational Electives / Field based Learning/ Research Project	In depth learning of major and minor disciplines, Skill sets for employability. Exposure to discipline beyond the chosen Subject Experiential learning/Research.	2+2 1+1 1+1
EXIT OPTION WITH BACHELOR DEGREE				
4thYear - (7th & 8th Semesters)	Deeper Concentration	Major Discipline Core and Elective Courses Research / Project Work with Dissertation	Deeper and Advanced Learning of Major Discipline Foundation to pursue Doctoral Studies & Developing Research competencies	4+4 4+4
EXIT OPTION WITH HONOURS DEGREE				
5th Year - (9th & 10th Semesters)	Master of the subject	Major Discipline Core and Elective courses/ Research/ Project Work with Dissertation	Deeper and Advanced Learning of the Major Discipline towards gaining proficiency over the subject	4+4/6+6
MASTERS DEGREE				

APPENDIX-1

COURSE PATTERN AND SCHEME OF EXAMINATION FOR B.SC. (ELECTRONICS) / B.SC. (HONS. IN ELECTRONICS)

Sl. No.	Semester	Title of the Paper	Teaching Hours	Hours / week		Examination Pattern Max. & Min. Marks /Paper						Duration of Exam (hours)		Total Marks / paper	Credits	
						Theory			Practical							
				Theory	Practical	Max.	Min.	IA	Max.	Min.	IA	Theory	Practical		Theory	Practical
1	**3**	ELE-CT 3.1: Programming in C and Digital Design using Verilog	**56**	**4**	**4**	**60**	**21**	**40**	**25**	**9**	**25**	**2.5**	**4**	**150**	**4**	**2**
		ELE-OE 3.1 / 3.2 / 3.3/3.4	**45**	**3**	**-**	**60**	**21**	**40**	**-**	**-**	**-**	**2.5**	**-**	**100**	**3**	**-**
2	**4**	ELE-CT4.1: Electronic Communicaion-1	**56**	**4**	**4**	**60**	**21**	**40**	**25**	**9**	**25**	**2.5**	**4**	**150**	**4**	**2**
		ELE-OE 4.1 / 4.2 / 4.3	**45**	**3**	**-**	**60**	**21**	**40**	**-**	**-**	**-**	**2.5**	**-**	**100**	**3**	**-**

Scheme of Internal Assessment Marks: **THEORY**

Sl. No.	**Particulars**	**IA Marks**
1	Attendance / Specified Activity in the syllabus	**05***
2	Internal Tests (Minimum of Two)	**25**
3	Assignments /Seminar / Case Study / Project work / Reports on - visits to industries/exhibitions/science centre's / active participation in Electronics competitions, etc.	**10**
	TOTAL Theory IA Marks	**40**

Scheme of Internal Assessment Marks: **PRACTICALS**

Sl. No.	**Particulars**	**IA Marks**
1	Practical Test	**05**
2	Report on datasheet of electronic devices / Seminar on electronics experiments, etc.	**15**
3	Active participation in practical classes	**05**
	TOTAL Practical IA Marks	**25**

Assesment:Weightage for Assessment
Common for both 3rd and 4th semester UG Electronics

Type of Assessment	Summative	Formative
Theory	60	40
Practical	**25**	**25**

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in variousfields of electronics both in industries and research.
2. To acquire experimental skills, analyzing the results and interpret data.
3. Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.
4. Capacity to identify and implementation of the formulate to solve the electronic related issues andanalyze the problems in various sub disciplines of electronics.
5. Capability to understand the working principles of the electronic devices and their applications.

Program Name	**B.Sc. in Electronics**	Semester	**Third Semester**
Course Title	**Programming in C and Digital Design using Verilog (Theory)**		
Course Code:	**ELE CT 3.1**	No. of Credits	**4**
Contact hours	**56 Hours**	Duration of SEA/Exam	**2.5 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 andlogic 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	**56Hrs**
Unit–1:	14Hrs

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:	14 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:	14 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:	14 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.

Program Name	**B.Sc. 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 programmers to be written and executed in each section			

Part -A: Programming in C Laboratory

Write and execute C Program to

Find the area and circumference of a circle

Find the biggest and smallest elements in a series

Find the factorial of a given number

Check the prime number in a series

Find the roots of quadratic equation

Find the gross salary of an employee

Remove all vowels from a string

Upper case and lower-case conversion and vice-versa

Reverse a string using library functions

Reverse a string without using library

Check whether the string is palindrome or not

Arrange the array in ascending and descending order using bubble sort

To perform arithmetic operations for a matrix.

Display prime numbers between intervals 0 to 100

Find GCD of two numbers.

Part – B: Verilog HDL Laboratory

Write and execute Verilog code to realize

Realization of logic gates.

Encoder without priority and with priority.

Multiplexer, De-multiplexer.

Comparator, Code converters – Binary to Gray and vice versa.

Adder/Subtractor (Half and Full) using different modelling styles.

4-bit parallel adder and 4-bit ALU/8-bit ALU.

SR, D, JK, T-flip-flops.

To realize counters: Up/Down (BCD and Binary).

4-bit Binary counter, BCD counters (Synchronous reset) and any arbitrary sequence counters.

4-bit Binary counter, BCD counters (Asynchronous reset) and any arbitrary sequence counters.

Modelling of Universal shift registers.

Program Name	**B.Sc. in Electronics**	Semester	**Third Semester**
Course Title	**ELE-OE 3.1: E-Business. (Theory)**		
Course Code:	**ELE OE 3.1**	No. of Credits	**3**
Contact hours	**45 Hours**		
OE Paper is to be offered for the Students other than Science stream			

Theory Contents	
Unit–1: E-BUSINESS	15 Hrs
Introduction, E-Commerce – definition, History of E-commerce, types of E-Commerce B to B etc. Comparison of traditional commerce and e-commerce. E-Commerce business models – major B to B, B to C model, Consumer-to-Consumer (C2C), Consumer-to-Business (C2B) model, Peer to-Peer (P2P) model – emerging trends. Advantages/ Disadvantages of ecommerce, web auctions, virtual communities, portals, e-business revenue models	
Unit -2: SECURITY FOR E-BUSINESS	15 Hrs
Security threats – An area view – implementing E-commerce security – encryption –Decryption, Protecting client computers E-Commerce Communication channels and web servers Encryption, SSL protocol, Firewalls, Cryptography methods, VPNs, protecting, networks, policies and procedures	
Unit -3: E-PAYMENTS	15 Hrs
E-payment systems – An overview. B to C payments, B to B payments. Types of E- payment system – Credit card payment, debit cards, accumulating balance, online stored value payment systems, digital cash, digital (electronic) wallets, agile wallet, smart cards and digital cheques. Secure Electronic Transaction (SET) protocol. RFID Concepts.	

References	
1	1.Marriappa E- Commerce
2	"E-Business", R.G.Saha, ,HPH
3	"E – Commerce & Accounting", M. Suman
4	"Frontiers of Electronic Commerce", Kalakota Ravi and A. B. Whinston, Addison.
5	"Electronic Commerce – the strategic perspective", Watson R T, The Dryden press.
6	"Business on the Net – Whats and Hows of ECommerce", Agarwala K.N and Deeksha Ararwala
7	"Business on the Net – Bridge to the online store front,", Agarwala and Ararwala
8	"E. Commerce", Murthy CSV, Himalaya Publishing House Pvt.Ltd.

Program Name	**B.Sc. 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)

Program Name	**B.Sc. 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 ofBasic 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

Demonstration experiments

Programming different types of Robots:

Temperature & Humidity controlled Robot (Fan Regulation, thermostat)
Infra-Red signal Controlled Robot (Measuring the speed of the vehicle)
Ultra-sonic signal operated Robot (automatic Tap system/Hand Drier/Floor drier)
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

Program Name	**B.Sc. 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.

Program Name	**B.Sc. in Electronics**	Semester	**Fourth Semester**
Course Title	**Electronic Communication-I (Theory)**		
Course Code:	**ELE CT 4.1**	No. of Credits	**4**
Contact hours	**56 Hours**	Duration of SEA/Exam	**2.5 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	**56 Hrs**
Unit–1:	14 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 fibers.
Antenna: Introduction, Antenna parameters, Ferrite rod antenna, yagi-Uda antenna, Dish-antenna, principle, Working and applications only

Unit -2:	14 Hrs

Analog Modulation: Amplitude Modulation, modulation index and frequency spectrum. Generation of AM (Emitter Modulation), Amplitude Demodulation (diode detector), Concept of Single side bandgeneration and detection. Frequency Modulation (FM) and Phase Modulation (PM), modulation index andfrequency spectrum, equivalence between FM and PM, Generation of FM using VCO, FM detector (slopedetector), 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:	14 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:	14 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, radiation 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.

Program Name	**B.Sc. 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
Construct amplitude modulator using transistor / I. C. Determination the modulation index.
Construct frequency modulator circuit – determine the modulation index.
"AM" Liner Diode detector- trace the input and output waveforms.
Frequency mixer circuit – Verify output frequency for different input frequencies.
"FM" Detector – Plot the frequency response curve.
Study of Balanced demodulator
Study of IF amplifier circuit.
Pulse amplitude modulation (PAM) – trace the output waveforms.
Pulse width modulation (PWM) – trace the output waveforms.
Pulse position modulation (PPM) – trace the output waveforms.
Characteristics of LED in OFC
Study of Numerical aperture
Study of OFC losses.
Setting up simple OFC Link.

Program Name	**B.Sc. 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 & applicationsOFC 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

Program Name	**B.Sc. in Electronics**	Semester	**Fourth Semester**
Course Title	**E-COMMERCE (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:	15Hrs
E-Security: Information system Security – Security on the Internet – E-business Risk Management Issues – Information Security Environment in India. Legal and Ethical Issues : Cybers talking – Privacy is at Risk in the Internet Age – Phishing – Application Fraud – Skimming – Copyright – Internet Gambling – Threats to Children .	
Unit -2:	15Hrs
e-Payment Systems: Main Concerns in Internet Banking – Digital Payment Requirements – Digital Token-based e-payment Systems – Classification of New Payment Systems – Properties of Electronic Cash – Cheque Payment Systems on the Internet – Risk and e-Payment Systems – Designing e-payment Systems – Digital Signature – Online Financial Services in India - Online Stock Trading.	
Unit -3: The Geometry of Virtual Worlds &The Physiology of Human Vision	15 Hrs
Information systems for Mobile Commerce:Mobile Commerce – Wireless Applications –Cellular Network – Wireless Spectrum – Technologies for Mobile Commerce – Wireless Technologies –Different Generations in Wireless Communication – Security Issues Pertaining to Cellular Technology. Portals for E-Business: Portals – Human Resource Management – Various HRIS Modules.	

References	
1	P.T.Joseph, S.J., "E-Commerce - An Indian Perspective", PHI 2012, 4th Edition.
2	David Whiteley , "E-Commerce Strategy, Technologies and Applications", Tata McGraw Hill, 2001
3	WEB REFERENCES: ➢https://www.docsity.com/en/e-commerce-notes-pdf-lecture-notes-universitylevel/2484734/. ➢https://magnetoitsolutions.com/blog/advantages-and-disadvantages-of-ecommerce. ➢https://www.researchgate.net/publication/320547139ECommerce_Merits_and_Demerits_A_Review_Pap .

Program Name	**B.Sc. 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.