Model Curriculum Content for Semester V and VI Electronics

Semester V

Program Name	**BSc in Electronics**	Semester	**Fifth Semester**
Course Title	**Communication -II**		
Course Code:	DSC-ELE51	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 various microwave devices and their working
- To understand the Principle and working of different RADAR Systems.
- To understand principle and working of different digital modulation techniques.
- To understand the Principle and working of Cellular communication and different wireless techniques.

Course Outcomes:

- Know the various microwave devices, their working and applications.
- Understand the principle and working of different RADAR Systems.
- Familiar with ASK, FSK, PSK, BPSK, QPSK Digital modulation techniques.
- Understand the basic concept of cell phone hand set, working principle of cellular communication and wireless technologies.

Contents	**60Hrs**
Unit 1	15 Hrs

Microwave devices for Communication: RF/Microwaves, EM spectrum, Wavelength and frequency, rectangular waveguides, circular waveguides, microwave cavities, microwave hybrid circuits, directional couplers, circulators and isolators, GUNN diode, READ diode, IMPATT diode, BARITT diode, PIN diodes, Schottky barrier diodes, Multicavity Klystron, Magnetron, block diagram of Microwave communication and working, Applications.

Unit 2	15 Hrs

RADAR Communication Systems: RADAR principles, frequencies and powers used in RADAR, maximum Unambiguous range, detailed block diagram of pulsed RADAR system, RADAR range equation-derivation, factors influencing maximum range, effect of ground on RADAR antenna characteristics, doppler effect, expression for Doppler frequency. MTI RADAR-block diagram, working, CW RADAR-block diagram, working, advantages, applications and limitations, FM CW RADAR-block diagram, numerical examples wherever applicable

Unit 3	15 Hrs

Digital communication: Block diagram of digital transmission and reception, Bit Rate, Baud Rate Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK).Advantage and

disadvantages of digital transmission, characteristics of data transmission circuits – Shannon limit for information capacity, bandwidth requirements, data transmission speed, noise, cross talk, echo suppressors, distortion and equalizer, MODEM– modes, classification.	
Unit 4	15 Hrs
Cellular Communication and Wireless LANs: Concept of cellular mobile communication – cell and cell splitting, frequency bands used in cellular communication, absolute RF channel numbers (ARFCN), frequency reuse, roaming and hand off, authentication of the SIM card of the subscribers, IMEI number, concept of data encryption, architecture (block diagram) of cellular mobile communication network, Multiplexing, FDMA, CDMA, TDMA, OFDMA, GSM .Wireless LAN requirements- Bluetooth, Wi-Fi, MIMO, LTE and 5G technology. Comparative study of GSM and CDMA, simplified block diagram of cellular phone handset, Major components of local area network-Primary characteristics of Ethernet-mobile IP, OSI model.	

Reference Books	
1	D Roddy and J. Collen, "Electronics communications", 4th edition, PHI, 2008
2	B. P. Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4th Edition, 2010
3	Bernard Skla 'Digital Communications: Fundamentals and Applications, Pearson Education, 2nd edition, 2009.
4	David Tse, Pramod Viswanath 'Fundamentals of Wireless Communication', Cambridge University Press,1st edition, 2005
5	Wayne Tomasi "Advanced Electronic Communication systems", - 6th edition, Low priced edition- Pearson education
6	Wayne Tomasi –"Electronic Communication systems, Fundamentals through Advanced", Vth edition.
7	Kennedy & Davis "Electronic Communication systems" , IVth edition-TATA McGraw Hill.

Program Name	**BSc in Electronics**	Semester	**Fifth Semester**
Course Title	**Communication-II Practicals**		
Course Code	DSC-ELE51P	No. of Credits	**2**
Formative Assessment Marks	**25**	Summative Assessment Marks	**25**
Note: Minimum of 8 Experiments from Part A and 4 Experiments from Part B			

Part - A

1. Study of ASK generation and Detection
2. Study of FSK generation and Detection
3. Study of PSK generation and Detection
4. Study of Time Division Multiplexing and Demultiplexing
5. Study of Frequency Multiplier.
6. QPSK modulator and demodulator
7. Determination of V-I Characteristics curve of a Gunn Diode
8. Study of notch filter.
9. Class C tuned amplifier
10. Study of Switched mode regulator using PWM.

Part- B

Simulation Experiments using MATLAB/SCILAB

1. Simulate NRZ, RZ, half-sinusoid and raised cosine pulses and generate eye diagram for binary polar signalling.
2. Pulse code modulation and demodulation system.
3. Computations of the Probability of bit error for coherent binary ASK, FSK and PSK for an AWGN Channel and compare them with their Performance curves.
4. DPSK Transmitter and receiver
5. QPSK Transmitter and Receiver.

Program Name	**BSc in Electronics**	Semester	**Fifth Semester**
Course Title	**Embedded Controllers**		
Course Code:	DSC-ELE52	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 know the importance of microcontrollers and its applications
- Understand the basics of Embedded Systems hardware and software concepts.
- Acquire knowledge about 8051 and PIC Microcontrollers and its peripherals.

Course Outcomes:

- Identify and understand function of different blocks of 8051 microcontrollers.
- Develop program for I/O port operations, Timers, Serial port and Interrupts using C.
- Gain the knowledge to interface LCD, Keyboard, ADC, DAC, DC motor, etc.
- Design and develop small scale embedded systems.

Contents	**60Hrs**
Unit 1	15 Hrs

Introduction: Embedded Systems, Examples of Embedded Systems, Design Parameters of Embedded Systems, Microcontrollers, Memory: Information Storage Device, Read Only Memory, Random Access Memory, Aligned and Unaligned Memory Accesses, The Microprocessor, Microprocessor Architecture Classification, Instruction Set Architecture, Memory Interface-Based Architecture Classification, Performance Comparison of Different Architectures, Software System and Development Tools, Software Sub-Systems, Software Development Tools, Debugging Tools and Techniques, Manual Methods, Software-Only Methods, Software-Hardware Debugging Tools.

Unit 2	15 Hrs

8051 Microcontroller: Architecture-Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing. Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples to use these instructions. 8051 Stack, Stack and Subroutine instructions. Assembly language program examples on subroutine and

involving loops.
Unit 3 — 15 Hrs
8051 Microcontroller Hardware Programming in C:Data types and time delays, I/O Programming, Timer Programming, Serial Communication- Basics of Serial Data Communication, RS-232 standard, 9 pin RS232 signals, UASRT Serial port programming, Interrupt programming, Keyboard and LCD Interfacing, ADC, DAC interfacing, Using Flash and EEPROM memories for data storage, Stepper motor and DC motor interfacing.
Unit 4 — 15 Hrs
PIC18 Microcontrollers: Overview of the PIC18 Family, Architecture and features of 18F458, Status register, Data memory and Special Function Registers, Data memory map, Access RAM, Indirect addressing and accessing tables in data memory, Program memory, Program memory map, Program Counter , Configuration registers, Stacks, Automatic Stack operations, Programmer access to the Stack, Fast Register Stack, Interrupts, Context saving with interrupts, Power supply and reset, Power supply, Power-up and Reset, Oscillator sources. Clock source switching, Parallel Ports, Parallel Slave Port, Watchdog Timer, Capture/Compare/PWM (CCP) Modules, MSSP Serial Port, Low-Voltage Detect, Nano-watt technology, Enhanced Peripherals.

Reference Books	
1.	Muhammad Tahir and KashifJaved, "ARM Microprocessor Systems: Cortex-M Architecture, Programming, and Interfacing," 1st Edition, CRC Press, 2017.
2.	Kenneth J. Ayala, "The 8051 Microcontroller", 3rd Edition, Thomson/Cengage Learning, 1997
3.	Muhammad Ali Mazidi and Janice Gillespie and Rollin D, "The 8051 Microcontroller and Embedded Systems using assembly and C,"1st Edition, Pearson, 2006.
4.	Tim Wilmshurst, "Designing Embedded Systems with PIC Microcontrollers: Principles and applications", First Edition, Elsevier, 2007.
5.	Muhammad Ali Mazidi and Rolin D, Mckinlay, "PIC Microcontroller and Embedded Systems using assembly and C for PIC18," 1stEdition, Pearson, 2008.
6.	John Pitman, "Design with PIC Microcontrollers," 1st Edition,Prentice Hall, 1997.

Program Name	**BSc in Electronics**	Semester	**Fifth Semester**
Course Title	**Embedded Controllers Practicals**		
Course Code	DSC-ELE52P	No. of Credits	**2**
Formative Assessment Marks	**25**	Summative Assessment Marks	**25**
Note: Minimum of 8 Experiments from Part A and any 4 either using 8051 or PIC from Part B			

Part -A

Conduct the experiments by writing C programs using KeiluVision IDE for 8051

1. To read 10 data from port P0 and store in internal RAM.
2. Find the square of a numbers (1to10) using look-up table
3. To read data from port P0 and send the data to P1 if it is even else send to P2 repeatedly.
4. To read data from port P0 convert it to decimal and send to P1 and P2 repeatedly.
5. To toggle P0 bit for every 500ms continuously use TIMER 0 to generate time delay.
6. To read switch status connected to P1.0 if switch is on, turn on LED connected P2.0 on or ifswitch is off, turn off LED.
7. To read switch status connected to P1.0 if switch is on set P2.0 on or if switch is off set P2.0off.
8. To stop/start toggling of LED connected to P0, when there is an external hardware interrupt.
9. To control traffic lights interface.
10. To transmit data “Hello Computer” to PC and receive data “Hi Microcontroller”, from PC using USART Serial port.

Part – B

Using and Keil vision IDE for 8051

1. To rotate stepper motor clockwise 180^0.
2. To display numbers from 0 to F on seven segment display.
3. To display text “Electronics” on 16x2 LCD display.
4. To put a main function at ROM address 0x100 and data “HELLO” at ROM address 0x200.
5. To convert analog data to digital using ADC.

Using MP Lab IDE for PIC

1. To monitor nit PC5, if it is High send 55H to PORT B; otherwise send AA to Port D
2. To convert Packed BCD ox29 ASCII and display The bytes on PORTB and PORTC
3. To send out the vale 44H serially one bit at a time via RC0, the LSB should go out first.
4. To convert analog signal to digital from external ADC and display the result on P2(any unused)port.
5. To control DC motor interfacing.

Program Name	**BSc in Electronics**	Semester	**Fifth Semester**
Course Title	**Electronic Instrumentation**		
Course Code:	DSC-ELE53	No. of Credits	**4**
Contact hours	**60 Hours**	Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives:

- Acquire the knowledge of various types of measurement systems and to know the importance of measuring instruments.
- To know different types of errors due to the measurement systems
- Gain the knowledge of working principle of sensors and actuators
- Understand the working principles of data acquisition systems

Course Outcomes:

- Able to calibrate the instruments to minimize measurement errors.
- Use different data acquisition systems to acquire real-time data
- Set up testing strategies to evaluate performance characteristics of different types of data acquisition system and develop professional skills in acquiring and applying the knowledge outside the classroom through design of a real-life instrumentation system.

Contents	**60Hrs**
Unit 1	15 Hrs

Measurement System: Introduction to general measurement system, significance of measurements, methods of measurements, instruments and measurement systems, Functions of instruments and measurement systems, Applications of measurement systems.

Instruments Performance Characteristics: Static Characteristics -Static error, static correction, scale range and scale span, reproducibility and drift, repeatability, Signal to noise ratio, sources of noise, accuracy, precision, linearity, hysteresis, threshold, dead time.

Dynamic Characteristics-Fidelity, frequency response, dynamic error, etc., problems.

Measurement Errors: Introduction, gross errors and systematic errors, absolute and relative errors, basic concepts of accuracy, precision, resolution, problems.

Unit 2	15 Hrs

Transducers: Classification of transducers, basic requirement of transducers, principle of operation and construction details of resistive, inductive, capacitive, temperature, ultrasonic, photoelectric, pressure, fiber optic and MEMS based transducers. Measurement techniques for motion, seismic, flow, level, humidity, pH, viscosity. Signal conditioning techniques using opamp instrumentation amplifier, carrier, chopper, isolation amplifier.

Unit 3	15 Hrs

Sensors and Actuators: Sensors-Introduction to sensors, types of sensors, typical application of sensors, basic principles and operations of Thermal Sensors, Optical Sensors, Acoustic Sensors, MEMS, Nano-sensors, Ultrasonic Sensors, Thin Film Sensors, Liquid Level Sensors, Magnetic

Sensors, Radiation Sensor **Actuators-**Introduction to actuators,types of actuators, Logical and Continuous Actuators, Pneumatic actuator, Electro-Pneumatic actuator, cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator, Control valves, Construction, Characteristics and Types, Selection criteria. Electrical actuating systems: Solid-state switches, Solenoids.

Unit 4	15 Hrs
Data Acquisition System-Introduction, generalized DAS, objective of DAS, uses of DAS, Single channel DAS, Multichannel DAS, Computer based DAS. **Computer-Controlled Instrument Test Systems-**Introduction, testing an audio amplifier, testing a radio receiver, instrument used in computer-controlled instrumentation, IEEE-488 electrical interface instrumentation bus.	

Reference Books	
1	Electronic Instrumentation, H S Kalsi, TMH, 2nd Edition, 2010
2	Electronic Instrumentation and Measurements, David A Bell, PHI/ Pearson Education, 2nd Edition, 2012.
3	Modern Electronic Instrumentation and Measurement techniques, Albert D Helfrick, William D Cooper, PHI, 2007.
4	Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, DhanpatRai& sons, 18th Edition
5	Patranabis D, “Sensors and Transducers”, Wheeler publisher, 1994
6	Instrumentation measurement and analysis, Nakra, Choudhary

Program Name	**BSc in Electronics**		Semester	**Fifth Semester**
Course Title	**Power Electronics**			
Course Code:	DSE-ELE51		No. of Credits	**3**
Contact hours	**45 Hours**		Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks		**40**	Summative Assessment Marks	**60**

Course Objectives:

- To know the working principles of power semiconductor devices
- Understand the basics of controlled rectifiers, choppers and inverters
- Gain the knowledge of application field of power electronics

Course Outcomes:

- Gain the knowledge on of use of power semiconductor devices for a given application
- Analyse the characteristic so of power semiconductor devices
- Know the behaviour of converters and inverters for different load conditions

Contents	**45Hrs**
Unit 1	15 Hrs

Introduction to power electronics- Concept of power electronics, applications of power electronics. Power electronic modules. **Power semiconductor devices**-Power diode-structure, characteristics and applications. Power transistor-types, switching characteristics and applications. MOSFET- operation, transfer characteristics and application.
Thyristors: Static V-I characteristics turn on methods, switching characteristics and Thyristor protection. IGBT-Structure and applications.

Unit 2	15 Hrs

Diode circuits: Diode circuits with DC source- R, L, C, RL, RC, RLC load, recovery of trapped energy, RL load with freewheeling diode.
Diode rectifiers: Half wave rectifiers with R, L, C, RL load with freewheeling

Unit 3	15 Hrs

Choppers- Basic principle, step-up and step- down choppers, types of chopper circuits- Type-A, Type-B, Type-C, Type-D and Type-E choppers. **Inverters:**Principle of operation, Pulse width modulated inverters. **Applications:** SMPS and UPS operation, **Introduction to motors:** Working principle of DC and AC motor.

Reference Books	
1	P.S. Bimbhra, "Power Electronics," 3rd Edition, 1999.
2	Mohammed H. Rashid, "Power Electronics," 3rd Edition.
3	M.D. Singh, K.B. Kanchandani, "Power Electronics," 2nd Edition.

Program Name	**BSc in Electronics**		Semester	**Fifth Semester**
Course Title	**VLSI Design**			
Course Code:	DSE-ELE52		No. of Credits	**3**
Contact hours	**45 Hours**		Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks		**40**	Summative Assessment Marks	**60**

Course Objectives:

- To understand the basics of Metal oxide semiconductor integrated circuits
- To have an overview of circuit design, subsystem design and layout

Course Outcomes:

- Write the stick diagram of various logic designs and to apply the lambda based design rules.
- Solve the problems of various circuits by calculation of basic parameters, design various subsystems and draw the layout.

Contents	**60Hrs**
Unit 1	15 Hrs

Introduction to MOS Technology- Introduction to integrated circuit technology, The integrated era, MOS and related VLSI Technology, Basic MOS Transistors, Enhancement mode transistor action, Depletion mode transistor action, NMOS Fabrication, CMOS fabrication, Thermal aspects of processing, BICMOS Technology, Production of E-beam Masks.CMOS Logic**;** The inverter, The NAND Gate, Combinational Logic, The NOR Gate, Compound Gates, Pass transistors and transmission gates, tristates, Multiplexers, Latches and Flip-flops.

Unit 2	15 Hrs

MOS and BICMOS Circuit Design Processes- MOS layers, Stick Diagram; NMOS design style, CMOS design style, Design rules and layout; Lambda based design rules, contact cuts, double metal MOS process rules, CMOS Lambda based design rules, Layout diagrams, Symbolic diagrams.

Unit 3	15 Hrs

Basic Circuit Concepts-Sheet Resistance, Sheet resistance concept applied to MOS transistors and Inverters, Area capacitances of layers, Standard unit of capacitance, some area capacitance calculations, the delay unit, inverter delays, driving large capacitive loads, propagation delays, wiring capacitances.

Reference Books	
1	Weste, Neil H. E.; Harris, David; Banerjee, Ayan, " CMOS VLSI Design: *A Circuits and System Perspective," 3rd Edition,* Pearson Education
2	Douglas A. Pucknell and Kamran Eshraghian, "BASIC VLSI DESIGN," 3rd ed.
3	John P. Uyemura, "Introduction to VLSI Circuits and Systems,".

Program Name	**BSc in Electronics**	Semester	**Fifth Semester**
Course Title	**Computer Networks**		
Course Code:	DSE-ELE53	No. of Credits	**3**
Contact hours	**45 Hours**	Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives:

- To understand the basics of network hardware and network software
- Clearly get the concept of various layers involved in the data communication with the help of reference models

Course Outcomes:

- Identify the application layer, transport layer, network layer and data link layer of the communication system.
- Calculation related to errors detection and correction problems involved in the data communication

Contents	**60 Hrs**
Unit 1	15 Hrs

Introduction- Uses of computer networks, network hardware; PAN, LAN, MAN, WAN, network software; protocol hierarchies, design issues for the layers, connection oriented versus connectionless service.

Unit 2	15 Hrs

Reference Models; The OSI reference model, the TCP/IP Reference model, A comparison of the OSI and TCP/IP reference models, Example Networks; The internet, the ARPANET, architecture of the internet, third generation mobile phone networks, wireless LANs.802.11, RFID and sensors Networks

Unit 3	15 Hrs

Different Layers- Application layers; network application architecture, process communication, transport services available to applications, transport services available to applications, transport services provided by the internet, application layer protocols, transport layer services, multiplexing and demultiplexing, the network layer; forwarding routing, virtual circuit and datagram networks.

Reference Books	
1	Computer Networks, *Fifth Edition*, by Andrew S. Tanenbaum and David J. Wetherall, published Education Inc.
2	Computer Networking: Atop- Down Approach, *6th Edition*, by Kurose, James F.; Ross, Keith W., published by Pearson Education, Limited.
3	Data Communications and Networking, 4th Edition, by Behrouz A. Forouzan, McGraw-Hill.

Program Name	**BSc in Electronics**	Semester	**Fifth Semester**
Course Title	**PCB Fabrication**		
Course Code:	Voc1-ELE51	No. of Credits	**3**
Contact hours	**45 Hours**	Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives:

- Acquire the knowledge of various types of PCB systems and its applications.
- Know different types of PCB
- Understand the designing and manufacturing techniques of PCB

Course Outcomes:

- Able to design different types of PCBs
- Learn the etching and soldering techniques.

Contents	**45 Hrs**
Unit 1	15 Hrs

Introduction: Advantages of PCB, components of PCB, Electronic components, IC's, Surface Mount Devices (SMD). **Classification of PCB** - single, double, multilayer and flexible boards, Manufacturing of PCB, PCB standards. **Types of PCB:** Single sided board, double sided, Multilayer boards, Plated through holes technology, Benefits of Surface Mount Technology (SMT), Limitation of SMT, Surface mount components: Resistors, Capacitor, Inductor, Diode and IC's. Demonstrate the identification of SMD, SMT devices.

Unit 2	15 Hrs

Layout and Artwork: Layout Planning: General rules of Layout, Resistance, Capacitance and Inductance, Conductor Spacing, Supply and Ground Conductors, Component Placing and mounting, Cooling requirement and package density, Layout check. Basic artwork approaches, Artwork taping guidelines, General artwork rules, Artwork check and Inspection.

Laminates and Photo printing: Properties of laminates, Types of Laminates, Manual cleaning process, Basic printing process for double sided PCB's, Photo resists, wet film resists, Coating process for wet film resists, Exposure and further process for wet film resists, Dry film resists. Demonstrate the identification of layout diagram on a single and multilayer PCB.

Unit 3	15 Hrs

Etching and Soldering: Introduction, Etching machine, Etchant system. Principles of Solder connection, Solder joints, Solder alloys, Soldering fluxes. Soldering, Desoldering tools and Techniques. **Technology OF PCB:** Design automation, Design Rule Checking; Exporting Drill and Gerber Files; Drills; Footprints and Libraries Adding and Editing Pins, copper clad laminates. Demonstrate the identification of soldering technology on a single and multilayer PCB.

Reference Books	
1.	Walter C. Bosshart "PCB Design and Technology," TMG Hill Publications, 1983.
2.	Clyde F. Coombs, "Printed circuits Handbook," 3rd Edn., McGraw Hill.

Program Name	**BSc in Electronics**		Semester	**Fifth Semester**
Course Title	**Python Programming**			
Course Code:	Voc1-ELE52		No. of Credits	**3**
Contact hours	**45 Hours**		Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks		**40**	Summative Assessment Marks	**60**

Course Objectives:

- Understands importance of Python programming language over other languages.
- To enable the students to learn the syntax and semantics of Python programming language.
- To demonstrate writing python programs.

Course Outcomes:

- Gain the knowledge of data types, operators, Input and output statements.
- Acquire knowledge of using the control statements, arrays, strings, functions of python.
- Able to solve the basic problems by writing python programs.

Contents	**45 Hrs**
Unit 1	15 Hrs

Introduction to Python: Python, Features of Python, Execution of a Python Program, Viewing the Byte Code Flavors of python, Python Virtual Machine (PVM), Frozen Binaries, Memory Management in Python, Garbage Collection in Python, Comparisons between C and Python, Comparisons between Java and Python.

Datatypes in Python: Built-in datatypes, bool Datatype, Sequences in Python, Sets, Literals in Python, User-defined Datatypes, Constants in Python, Identifiers and Reserved words, Naming Conventions in Python.

Operators in Python: Operator, Arithmetic Operators, Using Python Interpreter as Calculator, Assignment Operators, Unary Minus Operator, Relational Operators, Logical Operators, Boolean Operators, Bitwise logical operators, Membership Operators, in Operator, not in Operator, Identity Operators, is Operator, is not Operator, Operator Precedence and Associativity, Mathematical Functions.

Unit 2	15 Hrs

Input and Output, Output statements: print (), print("string"), print (variables list), print(object), print ("string", variables list), print (formatted string), Input Statements, Command Line Arguments, Parsing Command Line Arguments.

Control Statements: if, if ... else and if ... elif ... else Statements, while, for and Infinite Loops, Nested Loops, else Suite, break Statement, continue Statement, pass Statement, assert Statement, return Statement.

Arrays in Python: Array, Advantages of Arrays, Importing the Array Module, Indexing and Slicing on Arrays, Types of Arrays, Working with Arrays using numpy, Creating Arrays using array() , linspace, logspace, arange(), zeros() and ones() Functions, Mathematical Operations on Arrays , Comparing Arrays, Aliasing the Arrays Viewing and Copying Arrays, Slicing and

Indexing in numpy Arrays, Dimensions of Arrays, Attributes of an Array , ndim Attribute, shape Attribute, size Attribute, itemsize Attribute, dtype Attribute , nbytes Attribute, reshape() Method , flatten() Method, Working with Multi-dimensional Arrays , array() Function, ones() and zeros() Functions, eye() Function, reshape() Function, Indexing in Multi-dimensional Arrays, Slicing the Multi-dimensional Arrays, Matrices in numpy.

Unit 3	15 Hrs

Strings and Characters: Creating Strings, Length of a String, Indexing in Strings , Slicing the Strings, Repeating the Strings, Concatenation of Strings, Checking Membership , Comparing Strings, Removing Spaces from a String , Finding Sub Strings, Counting Substrings in a String, Replacing a String with another String , Splitting and Joining Strings, Changing Case of a String, Checking Starting and Ending of a String, String Testing Methods , Formatting the Strings, Working with Characters, Sorting, Searching in the Strings , Finding Number of Characters and Words, Inserting Sub String into a String

Functions: Difference between a Function and a Method, defining a Function, calling a Function, Returning Results from a Function, Returning Multiple Values from a Function Functions Are First Class Objects, pass by Object Reference, Formal and Actual Arguments, Positional Arguments, Keyword Arguments, Default Arguments, Variable Length Arguments, Local and Global Variables, Global Keyword, Passing a Group of Elements to a Function, Recursive Functions, Anonymous Functions or Lambdas. Overview to Lists and Tuples.

Reference Books	
1.	R. Nageswara Rao, “Core Python Programming”, Second Edition, Dreamtech Press.
2.	John V Guttag. “Introduction to Computation and Programming Using Python”, Second Edition, PrenticeHall of India.
3.	Wesley J. Chun. “Core Python Programming”, Second Edition, Prentice Hall.
4.	Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Pyhon”, Wiley India.

Semester VI

Program Name	**BSc in Electronics**	Semester	**Sixth Semester**
Course Title	**Signals and Systems**		
Course Code:	DSC-ELE61	No. of Credits	**4**
Contact hours	**60 Hours**	Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives:

- Gain the knowledge on Signals and Systems
- Understand the operations on Signals
- Know the frequency domain representation of signals
- Know the Laplace Transform and its properties

Course Outcomes:

- Distinguish between continuous-time and discrete-time signals and systems
- Do basic operations on signals
- Apply Laplace transform technique
- Find DTFS and IDTFS of the Signals

Contents	**60Hrs**
Unit 1	15 Hrs

Introduction to continuous-time and discrete-time signals: Understanding signals and systems, some real-world examples of signals and systems.mathematical and graphical representation of signals, Classification of signals: 1- and 2-D, continuous and discrete, periodic and non-periodic, symmetries (even-odd) etc., related problems to enhance understanding of different signal types, elementary signals – unit impulse, unit step, exponential and sinusoidal signals. Introduction to continuous-time and discrete-time systems, examples of systems, interconnections of systems, Properties of systems: Linear, Non-linear, time variance-invariance, causal-noncausal, memory-memoryless systems, feed-back in systems, stability, inverse systems.

Unit 2	15 Hrs

Operations on signals: amplitude scaling, shifting, folding, time scaling, addition of two signals etc., Time-domain representation of systems, Linear time-invariant systems, Convolution integral and convolution sum, impulse and step response of systems, differential equation representation of LTI systems, properties and stability of LTI systems, solving differential equations.

Unit 3	15 Hrs

Frequency domain representation of systems, magnitude and phase spectrum, Introduction to transforms, need for transforms.Laplace transforms, unilateral Laplace transforms, Properties, Inverse Laplace transforms,application of Laplace transforms for analysis of systems, solving differential equations, stability analysis of systems.

Unit 4	15 Hrs
Continuous-time Fourier series representation of periodic signals, convergence of Fourier series representation, properties of continuous-time Fourier series and problems Discrete-time Fourier Series properties of discrete-time Fourier series and problems IDFS.	

Reference Books	
1	Alan V Oppenheim, Alan s. Willsky and Hamid Nawab, "Signals and systems", Pearson edition Asia/PHI, 2nd Edition, 2002.
2	Simon Haykin and Barry Van Veen, "Signals & Systems," Wiley, 2nd Edition, 2021.
3	M J Roberts, "Signals and Systems Analysis Using Transform Methods and MATLAB,", TMG,
	Vinay Ingle, and John G. Proakias, "Digital Image Processing using MATLAB,"

Program Name	**BSc in Electronics**	Semester	**Sixth Semester**
Course Title	**Signals and Systems Practicals**		
Course Code	DSC-ELE61P	No. of Credits	**2**
Formative Assessment Marks	**25**	Summative Assessment Marks	**25**
Note: Minimum of 10 programmes to be written and executed.			

Write and execute following program using MATLAB/OCTAVE/SCILAB, etc.

1. Generate and plot unit sample, unit step, ramp, real sequences
2. Generate and plot sinusoidal, cosinusoidal and periodic sequences
3. Generate even & odd components of a sequence
4. Perform amplitude scaling, time scaling, folding and time-shifting operations on signals
5. Perform Upsampling and downsampling operation on a given sequence
6. Perform addition, subtraction and multiplication operation on signals
7. Find the linear convolution of two finite duration sequences.
8. Find the cross-correlation of two finite duration sequences
9. Evaluate & plot auto-correlation of a sequence
10. Compute the DTFS of a sequence and plot the magnitude and phase response
11. Compute the IDTFS of a sequence
12. Verify the sampling theorem

rogram Name	**BSc in Electronics**	Semester	**Sixth Semester**
Course Title	**Artificial Intelligence**		
Course Code:	DSC-ELE62	No. of Credits	**4**
Contact hours	**60 Hours**	Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives:

- Understand the basic concepts, techniques, and applications of artificial intelligence.
- Gain knowledge of different problem-solving methodologies and intelligent agents.
- Be able to apply machine learning algorithms for data analysis and pattern recognition.
- Acquire an understanding of natural language processing and computer vision.
- Develop an awareness of ethical considerations and societal impacts of artificial intelligence.

Course Outcomes:

- Explain the fundamental concepts, techniques, and applications of artificial intelligence.
- Apply problem-solving and search algorithms to solve simple AI problems.
- Implement basic machine learning algorithms for classification and clustering tasks.
- Understand and apply natural language processing techniques for text analysis.
- Understand and apply computer vision techniques for image analysis.
- Recognize ethical considerations and societal impacts of artificial intelligence.

Contents	**60Hrs**
Unit 1	15 Hrs
Definition, history, and goals of artificial intelligence. Intelligent agents: types, properties, and architectures. Problem-solving and search algorithms: uninformed search, informed search (heuristic search), and game playing	
Unit 2	15 Hrs
Predicate logic and first-order logic. Inference mechanisms: resolution, forward chaining, and backward chaining. Knowledge representation techniques: propositional logic, semantic networks, frames, and ontologies.	
Unit 3	15 Hrs
Introduction to machine learning: supervised learning, unsupervised learning, and reinforcement learning. Classification algorithms: decision trees, naive Bayes, and support vector machines.Clustering algorithms: k-means, hierarchical clustering	
Unit 4	15 Hrs
Natural language processing: language modelling, part-of-speech tagging, syntactic parsing, and	

sentiment analysis. Computer vision: image representation, feature extraction, object recognition, and image classification.

Reference Books	
1	Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig.
2	Artificial Intelligence: Foundations of Computational Agents by David L. Poole and Alan K. Mackworth.
3	Machine Learning: A Probabilistic Perspective by Kevin P. Murphy.
4	Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit by Steven Bird, Ewan Klein, and Edward Loper.

Program Name	**BSc in Electronics**		Semester	**Sixth Semester**
Course Title	**Mini Project**			
Course Code	DSC-ELE6MP		No. of Credits	**2**
Formative Assessment Marks		**25**	Summative Assessment Marks	**25**

Program Name	**BSc in Electronics**	Semester	**Sixth Semester**
Course Title	**Internet of Things**		
Course Code:	DSC-ELE63	No. of Credits	**4**
Contact hours	**60 Hours**	Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives:

- Understand the basic concepts and principles of the Internet of Things.
- Gain knowledge of different IoT technologies and protocols.
- Acquire practical skills in designing and implementing IoT applications.
- Develop an understanding of IoT security and privacy considerations.

Course Outcomes:

- Understand the basic concepts and principles of the Internet of Things.
- Gain knowledge of different IoT technologies and protocols.
- Acquire practical skills in designing and implementing IoT applications.
- Develop an understanding of IoT security and privacy considerations.

Contents	**60Hrs**
Unit 1	15 Hrs
Definition and evolution of the Internet of Things.IoT architecture and components.IoT communication protocols: MQTT, CoAP, HTTP.IoT application domains and use cases.	
Unit 2	15 Hrs
Overview of IoT devices: microcontrollers, sensors, actuators.Types and characteristics of sensors used in IoT applications. Interfacing sensors with microcontrollers. Data acquisition and sensor fusion techniques.	
Unit 3	15 Hrs
Wireless communication technologies for IoT: Wi-Fi, Bluetooth, Zigbee, LoRaWAN, etc.IoT network topologies: star, mesh, and hybrid networks.oT data management and storage.IoT protocols for device-to-device and device-to-cloud communication.	
Unit 4	15 Hrs
IoT application development platforms and frameworks.Design and implementation of IoTapplications.IoT security challenges and solutions.Privacy and ethical considerations in IoT.	

Reference Books	
1	Internet of Things: Principles and Paradigms by RajkumarBuyya, Amir VahidDastjerdi, and Anton Y. Dongarra.
2	Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry by MaciejKranz.
3	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things by David Hanes, Gonzalo Salgueiro, Patrick Grossetete, and Robert Barton.
4	Internet of Things with Arduino Cookbook" by Marco Schwartz
5	Arduino Home Automation Projects" by Marco Schwartz and Oliver Manickum

Program Name	**BSc in Electronics**	Semester	**Sixth Semester**
Course Title	**Cyber Security**		
Course Code:	DSE-ELE61	No. of Credits	**3**
Contact hours	**45 Hours**	Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives:

- Learn the foundations of Cyber security and threat landscape.
- To equip students with the technical knowledge and skills needed to protect and defend against cyber threats.
- To develop skills in students that can help them plan, implement and monitor cyber security mechanisms to ensure the protection of information technology assets.

Course Outcome:

- Understand the cyber security threat landscape.
- Develop a deeper understanding and familiarity with various types of attacks, cyber crimes, vulnerabilities and remedies thereto.
- After completion of this course, students would be able to understand the concept of cyber security and issues and challenges associated with it.
- Students at the end of this course, should be able to understand the cyber crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.

Contents	**60Hrs**
Unit 1	15 Hrs

Defining Cyberspace and overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, internet society, regulation of Cyberspace, Concept of cyber security, Issues and challenges of cyber security.

Unit 2	15 Hrs

Classification of cyber crimes, Common cyber crimes- cyber crime targeting comouters and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks zero day and zero click attacks, cybercrinals modus-operandi.

Unit 3	15 Hrs

Reporting of cyber crimes, Remedial and mitigation measures, legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber Crime and offences, Organizations dealing with cyber crime and cyber security in India, Case studies.

Practical:

1. Checklist for reporting cyber crime at Cyber crime Police Station.

Checklist for reporting cyber crime online.

3. Reporting phishing emails.
4. Demonstration of email phishing attack and preventive measures.

Reference Books	
1	Cyber crime impact in the New Mllennium, by R C Mishra, Auther Press. Edition 2010.
2	Cyber Security understanding cyber crimes, Computer Forensics and legal perspectives by SumitBelapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
3	Security in the Digital Age:Social media security threats and Vunerabilities by Henry A Oliver, Create space Independent Publishing Platform.(Pearson, 13th November, 2001

Program Name	**BSc in Electronics**	Semester	**Sixth Semester**
Course Title	**Control Systems**		
Course Code:	DSE-ELE62	No. of Credits	**3**
Contact hours	**45 Hours**	Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives:

- To know the importance of electronic control systems
- Understand the behaviour of first and second order systems
- To know the difference between open and closed loop control systems

Course Outcomes:

- Distinguish between the stable and nonstabe systems
- Learn the block diagram reduction techniques
- Decide the type of control system to be selected for a given application

Contents	**60Hrs**
Unit 1	15 Hrs

Introduction to systems, Control systems, need for control,Classification of Systems,
Open loop and Closed Loop Control System with examplesBIBO stability of systems
Mathematical models of physical systems: Introduction, differential equation of physical systems, mechanical systems, electrical systems, Analogous systems, Force (Torque)-Voltage and Force (Torque)- Current analogyReview of Laplace TransformsTransfer functions of armature controlled and field controlled servomotors, Block diagram algebra, block diagram reduction,Signal flow graphs, Mason's gain formula.

Unit 2	15 Hrs

Time response analysis: Introduction, standard test signals, Transfer function of systems, time response of first order system subjected to unit step input, Second Order Systems, Unit Step Response of Underdamped Second Order Systems, Concepts of Rise Time, Peak Time, Maximum Peak Overshoot and Settling Time, Steady state error and static error constants,
Type (Type-0, Type-I, Type-II) of feedback control systems. Concept of stability: The concept of stability, necessary conditions for absolute stability, conditional and relative stability,Stability analysis in the s-domain.

Unit 3	15 Hrs

Determining stability of systems using different techniques:Routh-Hurwitz stability criterion, relative stability analysis. Frequency Response, magnitude and phase plots, polar plots, Relative Stability – Gain and Phase Margins Nyquist Stability Criterion, Nyquist Plots, Bode Plots (understanding the plots and determining PM and GM and hence stability of systems from Nyquist/Bode plots). Controllers – P, PI, PD and PID controllers, Transfer function and comparison Lead, Lag and Lag-Lead Compensators, comparison (introductory concepts only).

Reference Books	
1	Katsuhiko Ogata, Modern Control Engineering, Prentice Hall.
2	Benjamin C. Kuo, Automatic Control Systems, Prentice Hall.

Program Name	**BSc in Electronics**		Semester	**Sixth Semester**
Course Title	**Robotics**			
Course Code:	DSE-ELE63		No. of Credits	**3**
Contact hours	**45 Hours**		Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks		**40**	Summative Assessment Marks	**60**

Course Objectives:

- To acquire the working principle of robots
- Understand the working principle of sensors
- To know the working principles of actuators

Course Outcomes:

- Design an embedded system for the working of a robot.
- Select the robot type depending on the application requirments.
- Acquire the basic robot programming skills

Contents	**60Hrs**
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

Hands on session (to be considered for internal assessment)

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

Reference Books	
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
7.	Robotics for Engineers –Yoram Koren, McGraw Hill International, 1st edition, 1985
8.	Robotic Engineering - An Integrated approach, Klafter, Chmielewski and Negin, PHI, 1st edition, 2009
9.	An Introduction to Automated Process Planning Systems- Tiess Chiu Chang & Richard A. Wysk

Program Name	**BSc in Electronics**		Semester	**Sixth Semester**
Course Title	**Mobile app Development**			
Course Code:	Voc2-ELE6-V1		No. of Credits	**3**
Contact hours	**45 Hours**		Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks		**40**	Summative Assessment Marks	**60**

Course Objectives:

- To know the architecture and working of different operating systems
- To learn the Android framework

Course Outcomes:

- Acquire the mobile app development skills
- Gain the hands on experience of designing mobile apps

Contents	**45Hrs**
Unit 1	15 Hrs

Introduction: What is mobile Application Programming, Different Platforms, Architecture and working of Android, iOS and Windows phone 8operating system, Comparison of Android, iOS and Windows phone 8

Android Development Environment: What is Android, Advantages and Future of And roid, Tools and about Android SDK, Installing android 5.0 or higher versions, AVDs:Smartphone Emulators, Image Editing

Android Software Development Platform: Understanding Java SE and the Dalvik Virtual Machine, Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML, Screen Sizes, Launching Your Application: TheAndroidManifest.xml File, Creating Your First Android Application.

Unit 2	15 Hrs

Android Framework Overview: The Foundation of OOP, The APK File, Android Application Components, Android Activities: Defining the User Interface, Android Services: Processing in the Background, Broadcast Receivers: Announcements and Notifications, Content Providers: Data Management, Android Intent Objects: Messaging for Components, Android Manifest XML: Declaring Your Components.

Graphics Resources in Android: Introducing the Drawable, Implementing Images, Core Drawable Subclasses, Using Bitmap, PNG, JPEG and GIF Images in Android.

Unit 3	15 Hrs

Hands on development using android studio

1. Simple calculator app using android 5.0
2. Registration form app using android 5.0
3. Login form app using android 5.0
4. Quiz app using android 5.0
5. To –do app using android 5.0

Reference Books	
1.	Beginning Android 4, OnurCinar , Apress Publication
2.	Professional Android 4 Application Development, Reto Meier Wrox
3.	Beginning iOS 6 Development: Exploring the iOS SDK, David Mark, Apress
4.	Beginning Windows 8 Application Development, IstvánNovák, ZoltanArvai, György Balássy and David Fulop
5.	Professional Windows 8 Programming: Application Development with C# and XML, Allen Sanders and Kevin Ashley, Wrox Publication
6.	Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014.
7.	Dawn Griffiths and David Griffiths, "Head First Android Development," 1st Edition, O'Reilly SPD Publishers, 2015.
8.	J F DiMarzio, "Beginning Android Programming with Android Studio," 4th Edition, Wiley India Pvt Ltd, 2016.
9.	Anubhav Pradhan, Anil V Deshpande, " Composing Mobile Apps" using Android, Wiley 2014.

Program Name	**BSc in Electronics**	Semester	**Sixth Semester**
Course Title	**Animation and Multimedia**		
Course Code:	Voc2-ELE6-V2	No. of Credits	**3**
Contact hours	**45 Hours**	Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Objectives:

- Developing the basic skills necessary for the student to produce digital character based animation, titles for film and video.
- To understand how Multimedia can be incorporated.
- Understand the concepts in animation.

Course Outcomes:

- Define and apply design principles and theories to animation production.
- To provide academic research and skills for a successful career in animation and multimedia
- Understand multimedia components using various tools and techniques.

Contents	**45Hrs**
Unit 1	15 Hrs

Multi Media Fundamentals- Multimedia, Multimedia Objects, Multimedia in business and work, Multimedia hardware, Memory & Storage devices, Communication devices, Presentation tools, object generation which includes video sound; image capturing, Authoring tools, card and page based authoring tools, Perception of sound, hearing sensitivity, frequency range, sound- wave length, the speed of sound. measuring the sound, musical sounds, noise signal, dynamic range, pitch, harmonics-equalizationreverberation time, Sound isolation and room acoustics- treatments-studio layout –room dimensions. The Basic set-up of recording system; The production chain and responsibilities. Microphones types -phantom power, noise, choosing the right mike; Mixing console; Input devices; Output devices; Audio Publishing

Unit 2	15 Hrs

Graphics /Image/video-image file formats and how and where it is used, Principles of animation, 2D and 3D animation, Morphing, Kinematics, tweening, Motion capture, character animation, modeling, special effects, and compositing, Video Conferencing, Web Streaming, Video Streaming, Internet Telephony - Virtual Reality - Artificial intelligence. different types of video camera including Handy Camera, Tape Formats, Analog Editing, Editing Equipment's and Consoles, Video Signal, Video Format, Video Lights - Types and Functions. Uses of Tripod-Types. Clapboard- Usage. Light meter. Other Useful Accessories.

Unit 3	15 Hrs

Interactive Animation Techniques-History of animation: Types of animation: case study, Understanding and learning the Principles of animation through the view of different animation films: case study, Drawing the detail storyboard for the animation film Drawing the background in layers and symbols Creating the characters in turn around Creating the props Creating the scenes with tween and animation Completing the whole animation film with background music and dialogues.

Reference Books	
1.	Tay Vaughan, "Multimedia: Making it Work," 9th Edition, McGraw Hill Education.
2.	Ranjan Parekh, "Principles of Multimedia," 2nd Edition, McGraw Hill Education, 2013.
3.	Frank Thomas and Odie Johnson, "The Illusion of Life: Disney Animation, Disney Editions," 2014.
4.	Williams, R. "The Animator's Survival Kit," Faber & Faber, 2011.

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