B. Sc I Semester

DSC 1A: Network Theorems, Analog and Digital Devices

Theory: 60 Lectures (Credits: 04)

Course Outcomes:

At the end of this course students will be able to

- Study and analyze basic network using network theorems.
- Describe the behavior of basic semiconductor devices, like diode, BJT, FET, etc.
- To know the behavior, characteristics of Varactor, Schottky, Tunnel, Pin, Gunn and LED .
- Understand the number systems and their conversions. Familiarization of basic gates and Boolean Algebra.
- Understand the basic knowledge of digital system building blocks. Construct simple digital design based on Boolean algebra.

Contents:

Unit 1: **15 hrs**

Network Theorems: Thevinin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Superposition theorem and Milkman's theorem (Qualitative only)

Semiconductor devices:- P-N Junction diode, (ideal, practical) construction, working, I-V Characteristics, Forward and Reverse resistances.

Zener diode: Construction, working, I-V Characteristics, Zener and Avalanche breakdown.

LED: Construction, working and characteristics

Varactor diode: Construction, working and characteristics

Unit 2: **15hrs**

Schottky diode: Construction, working and characteristics

Tunnel diode: Construction, working and characteristics

Gunn diode: Construction, working and characteristics

Pin diode: Construction, working and characteristics

BJT: Construction, types, CB, CE, CC configuration. I-V characteristics of CB and CE configuration:Active, cut-off, saturation regions, Leakage current, current gain and their relations.

Unit 3: **15 hrs**

JFET: Types – P-channel, N-channel, constructions and working and I-V Characteristics (N–channel only). Parameters and their relations. Comparison of BJT and JFET

MOSFET: E-MOSFET, D-MOSFET, N-channel, P-channel, construction, working and symbols, Biasing, Drain and transfer characteristics. C-MOS inverter circuit and working characteristics.

IGBT: Construction, working and characteristics

UJT: Construction, working and characteristics

SCR: Construction, working and characteristics

Power Devices: Diac and Triac – construction, working and I-V Characteristics

Opto Devices: Photo diode, LDR, Photo Transistor, Thermistor, solar cell, FND

Unit 4: **15 hrs**

Number System: Decimal, Binary, Octal and Hexadecimal number systems, base conversions. Binary arithmetic – addition, subtraction by 1's and 2's complement methods. BCD Code (8421)

Logic Gates: OR, AND, NOT, NAND, NOR, X-OR and X-NOR universal properties of NOR and NAND gates.

Boolean Algebra: Boolean laws, Demerger's theorem, simplification of Boolean expressions SOP only.

Reference Books:

1. Basic Electronics by B.L.Theraja
2. Basic Electronics and Linear circuits by N.N.Bhargava
3. Microwave devices and circuits by Samuel-Y-Liao
4. Electronics Principles by Albert Malvino : David J Bates (7^{th} edition)
5. Fundamentals of Digital circuits by A Anand Kumar (4^{th} edition)
6. Textbook of Electrical Technology by B.L.Therja – A.K.Theraja
7. Electronic devices and circuits by David.A.Bell (4^{th} edition)
8. A Text-Book of Applied Electronics by R.S. Sedha
9. Digital Fundamentals by Thomas . L . Floxd (10^{th} edition)
10. Digital principles and application by Donald P Leach, Albert Paul Malvino, Gautam Saha(8^{th} edition)

BSc II Semester

DSC 1B: Analog and Digital Circuits

Theory: 60 Lectures (Credits: 04)

Course outcomes:-

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

1. Understand the concept of Rectifiers principles, operations, different types of Performance & characteristics.
2. Understand the concept of filter circuit and differentiate various types of filters.
3. Understand concept of the Voltage Regulator circuits & their comparison linear, switching, shunt & series types.
4. Understand the various Wave shaping circuits and techniques in Practical electronics applications.
5. Understand the fundamental principle and operation of different types of transistors, design and analyze various transistor amplifier configurations, and their applications.
6. Understand the working principle of both Linear and Non-Linear oscillators.
7. Understand the design, basic logic circuits, analyze the performance and applications of digital circuits.
8. To develop data conversion and processing techniques, further design and implementation of data acquisition processing and storage in embedded devices.

Unit-1:- **15 Hrs**

Rectifiers: HWR, FWR (center tapped & bridge) circuit diagram working and waveforms, Expression for ripple factor and efficiency, Diode as a Switch.

Filters: Shunt Capacitor filter, Series inductor filter & π filters.

Voltage Regulators: Block Diagram of regulated Power Supply, Zener Diode as voltage regulator Line & Load Regulation. Fixed & Variable IC voltage regulators: 78XX, 79XX, LM317.

Wave shaping circuits: Clipping Positive, Negative, biased and combination clippers circuit diagram and waveforms.

Unit-2:- **15 Hrs**

Clamping circuits: Positive, Negative clamper and biased clamper circuit diagram and waveforms.

Voltage Control Oscillators (VCO's): Circuit diagram & Working using varactor diode.

Transistor biasing & stabilization: Fixed bias & Voltage divider bias-derivation for Stability factor & thermal runway.

Amplifier: CE-amplifier Circuit diagram, working of Small signal Single stage amplifier frequency response curve, Emitter follower Construction & working.

Unit-3:- **15 Hrs**

Amplifier classification: Class A, Class-B, Class-AB & Class-C amplifiers construction & working.

Cascading amplifier: 2-Stage RC-coupled and Transformer coupled amplifier - Circuit diagram, working & frequency response.

Feedback amplifier: Concept of feedback, Positive & Negative feedback (Qualitative -analysis)

FET amplifier: Common Source, Construction working & frequency response.

Oscillators: Concept of Barkhausen Criterion. Hartley and Collipts's oscillator- Construction, working & waveforms, Wein bridge oscillator & phase shift oscillator - Construction, working & waveforms.

Unit-4:- **15 Hrs**

UJT as a relaxation oscillator - Construction & working.

SCR-Half wave rectifier and full wave rectifier Construction, working & wave forms.

Multivibrators: Astable multivibrator, Monostable multivibrator, & Bistable multivibrator- Construction, working & waveforms.

Arithmetic Circuits: Binary addition, Half adder, Full adder, Half & Full Substractor, Four bit-binary adder.

Data Processing Circuits: Multiplexers, Demultiplexer, Decoders & Encoders.

Reference Books:

1. Basic Electronics by B.L.Theraja.
2. Basic Electronics and Linear circuits by N.N.Bhargava.
3. Microwave devices and circuits by Samuel-Y-Liao.
4. Electronics Principles by Albert Malvino: David J Bates (7th edition).
5. Fundamentals of Digital circuits by A Anand Kumar (4th edition).
6. Textbook of Electrical Technology by B.L.Therja A.K.Therja.
7. Electronic devices and circuits by David.A.Bell (4th edition).
8. A Text-Book of Applied Electronics by R.S. Sedha.
9. Digital Fundamentals by Thomas. L. Floxd (10th edition).
10. 10. Digital principles and application by Donald P Leach, Albert- -Paul Malvino, Gautam Saha (8th edition).

THIRD SEMESTER

Program Name	BSc in Electronics	Semester	Third Semester
Course Title	Linear and Digital Integrated Circuits		
Course Code	DSC-ICT 3	No of Credits	4
Contact hours	60 Hours	Durationof SEA/Exam	3 hours
FormativeAssessment Marks	20	SummativeAssessmentMarks	80

ourse Objectives: Upon successful completion of the course the students should be able

- To become familiar with various working principles of widely used electronic devices.
- To have knowledge of linear and digital ICs
- To help the students to build small projects
- To be able to answer some basic questions that appears in competitive examinations.

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

- Reproduce the characteristics and parametersoperational amplifiers,
- Apply standard device models to explain/calculate critical internal parameters ofsemiconductor devices.
- Utilize the diverse applications of op-amps in circuits.
- Analyze sequential circuits.
- To build the digital modules with the use of ICs circuits

Contents	60 Hours
nit-1	*15 Hours*

perational amplifiers : definition, symbol, pin-diagram(IC741). Introduction to differential amplier. emitter upled differential amplifier, construction and working .block diagram of op-amp,characteristics of an ideal d practical operational amplifier. Op-amp parameters-CMRR. Slew rate,SVRR. & frequency response. ncept of virtual ground.

pplications of Op-amps: inverting and non-inverting amplifiers, adder, subtractor differentiator and tegrator. Wein bridge oscillator, phase shift oscillator (qualitative analysis only), comparator and zero ossing detector.

nit-2	*15 Hours*

ctive Filters: First and second order low pass and High pass butter worth filters- construction, working and

frequency response curves (qualitative analysis only)

IC 555 timer: Pin diagram, functional block diagram.Multivibrators –astable, monostable and bistablemultivibrators using 555 timer-working, equation for frequency of oscillations (qualitative analysis only) Schmitt trigger using IC 555-waveforms, mention of UTP and LTP.

Voltage regulators- IC 317, 337 and 723. Pin configuration and working as regulators

Unit-3	*15 Hours*

Digital Circuits

Sequential Logic Circuits: Flip-flops: Basic RS flip-flop (using NOR gates), clocked RS flip-flop (using NAND gates), D flip-flop, edge-triggered D flip-flop, JK flip-flop, master-slave JK flip-flop, T flip-flop, Preset and clear conditions, Applications of flip-flops in semiconductor memories, ROM, and RAM types (qualitative analysis only)

Registers: Introduction, Types: serial-in-serial-out, serial-in-parallel-out, parallel-in-serial-out, parallel-in-parallel-out shift registers (only 4-bit)

Unit-4	*15 Hours*

Counters (4 bits): asynchronous counters and Synchronous counter.Up-down counter (asynchronous only). Modulus of a counter, mod-3, mod-5 counter, decade counter ring counter.

Data converters- D/A and A/D conversion: types, R-2R D-A converters, circuit and working. Successive approximation ADC.

Digital IC-families: Digital IC terminology, standerd TTL series charecteristics TTLopen collector outputs, MOSand CMOS series charecteristics.

REFERENCE BOOKS

1.	OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
2.	Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, 2011, Oxford University Press.
3.	Digital Principles and Applications, A.P. Malvino, D P.Leach and Saha, 7th Ed., 2011, Tata McGraw.
4.	Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd
5.	Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
6.	Digital Systems: Principles &Applications,R.J.Tocci, N.S.Widmer, 2001, PHI Learning.
7.	Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994).
8.	R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994).
9.	Digital Electronics, S.K. Mandal, 2010, 1st edition, McGraw Hill.

Fourth semester

Program Name	BSc in Electronics		
Course Title	Programming in C and Digital Design using Verilog	Semester	Fourth Semester
Course Code	DSC-IDT 4	No.of Credits	4
Contact hours	60 Hours	Durationof SEA/Exam	3hours
Formative Assessment Marks	20	Summative Assessment Marks	80

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

- The ability to code and simulateany digital function in Verilog HDL.
- Know the difference between synthesizable and non-synthesizable code.
- Understand library modeling, behavioral 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: After the successful completion of the course, the student will be able to:

- Apply the acquired knowledgeof digital circuits in different levels of modeling usingVerilog HDL.
- Apply the acquired knowledge of digital circuits in different levels of modeling usingVerilogHDL.
- Design and verify the functionality of digital circuit/system using test benches.
- Develop the programs more effectively using directives, Verilog tasks and constructs. Design and analyze algorithms for solving simple problems.
- Write and execute and debug C codes for solving problems.

Contents	*60Hours*
Unit–1:	*15 Hours*

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-dimensionalarrays.Inputoutputstatement–sprintf(),scanf()andgetch(),andlibraryfunctions(mathand string related functions)

Unit-2:	*15 Hours*

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

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

Pointers: Pointer declaration, assigning value stop 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 Hours*

Introduction to Verilog :A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and Verilog.

Verilog: Module, Delays, brief description - data flow style, behavioral style, structural style, mixed design style, simulating design.

Language Elements- Introduction, Keywords, Identifiers, White Space Characters, Comments, format, Integers, reals and strings. Logic Values, Data Types-net types, undeclared nets, scalars and vector nets, Register type, Parameters.

Expressions: Operands, Operators, types of Expressions

Unit-4:	*15 Hours*

Gate level modelling - Introduction, built in Primitive Gates, multiple input gates, Tri-state gates, pull gates, MOS switches, bidirectional switches, gate delay, array instances, implicit nets.

Data flow Modelling: Continuous assignment, net declaration assignments, delays, net delays and example

Behavioural Modelling: Procedural constructs, timing controls, block statement, procedural assignment, conditional statement, loop statement, procedural continuous assignment.

Program Name	**BSc in Electronics**	Semester	**Fifth Semester**
Course Title	**Electronic Communication-Analog and Digital (Theory)**		
Course Code:	**ELE CT 5**	No. of Credits	**4**
Contact hours	**60 Hours**	Duration of SEA/Exam	**3 hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

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 Fiber 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 and wave guides (Qualitative only).

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

Microstrip antenna- Types, feeding methods, structure, radiation pattern and applications.

Unit–2:	**15 Hrs**

Analog Modulation: Amplitude modulation(derivation for instantaneous voltage), modulation index and power relations(derivations),frequency spectrum. Generation of AM (Emitter Modulation). Amplitude Demodulation (diode detector), Concept of Single sided band generation and detection AM-transmitter and receiver (SHD-Receiver). Frequency Modulation (derivation for instantaneous voltage), modulation index and frequency spectrum. Comparison between FM and AM. Generation of FM using VCO, FM detector (slope detector), FM-Transmitter and qualitative idea of super heterodyne FM receiver. Phase Modulation (PM-Qualitative)

Unit–3:	**15 Hrs**

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

Digital communication: Need for digital transmission, Block diagram of digital transmission and reception, concepts of companding and quantization. Pulse Code Modulation and delta modulation.

Digital Carrier Techniques: Bit Rate and Baud Rate. Generation and detection of Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK)- Applications of each techniques. Advantage and disadvantages of digital transmission, Shannon limit for information capacity, bandwidth requirements, data transmission, speed, noise and cross talk. MODEM– modes and classification.

Unit-4	**15 Hrs**

Introduction to Satellite Communication System: 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.

Optical Fiber Communication: Optical Fibers: types of fibers and Structure. Principle of light transmission in optical fiber. Basic optical laws and definitions, Rays and modes in fiber. Losses in Optical fiber attenuation, scattering losses, radiative losses, absorption losses, core and cladding losses. Connectors and Splicers, Block diagram of optical fiber communication system

Optical sources: LEDs and Laser diodes: Construction, working and V-I characteristics

Optical Receivers: Photodiode & PiN diode-Construction working and V-I Characteristics

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.

ProgramName	BScin Electronics	Semester	SixthSemester
CourseTitle	EmbeddedControllers and Internet of Things(Theory)		
CourseCode:	DSC-ELE 6T	No.ofCredits	4
Contacthours	60Hours	DurationofSEA/Exam	3Hours
FormativeAssessmentMarks	20	SummativeAssessmentMarks	80

CourseObjectives:

- Toknowtheimportanceofmicrocontrollersanditsapplications
- Understandthe basicsofEmbeddedSystemshardwareandsoftware concepts.
- Acquireknowledgeabout 8051andPICMicrocontrollersanditsperipherals.
- Understandthebasicconceptsandprinciplesoftheln ternetofThings.
- Gainknowledge ofdifferentIoTtechnologiesandprotocols.
- AcquirepracticalskillsindesigningandimplementingIoTapplications.

CourseOutcomes:

- Identifyandunderstandfunctionofdifferentblocksof8051microcontrollers.
- DeveloppramforI/Oportoperations,Timers,SerialportandInterruptsusingC.
- GaintheknowledgetointerfaceLCD,Keyboard,ADC,DAC,DCmotor,etc.
- Designanddevelopsmallscaleembeddedsystems.
- Understandthebasicconceptsandprinciplesoftheln ternetofThings.
- Gainknowledge ofdifferentIoTtechnologiesandprotocols.
- AcquirepracticalskillsindesigningandimplementingIoTapplications.

Contents	60Hrs
Unit1	15Hrs

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.SimpleAssemblylanguageprograms tousetheseinstructions.

8051Stack,StackandSubroutineinstructions.Assemblylanguageprogramexamplesonsubroutineand involvingloops

Unit2	15Hrs

8051 Microcontroller Hardware Programming in C: Data types and time delays, I/O Programming, Timer Programming, Serial Communication- Basics of Serial Data Communication, UASRT Serial port programming. Interfacing 8051 to Keyboard, LED, Relay, ADC, DAC, and Stepper motor.

PIC18 Microcontrollers: Overview of the PIC18 Family, Architecture and features of 18F458, Status register, Data memory and Special Function Register Program Counter,

Configurationregisters, Stacks, Automatic Stackoperations, Programmer access to the Stack, FastRegister Stack, Interrupts. Power supply and reset, Power supply, Power-up and Reset, Oscillator sources. Clocksource switching,Parallel Ports, Parallel Slave Port, Watchdog Timer, Capture/Compare/PWM (CCP) Modules, MSSP Serial Port, Low-Voltage Detect, Nano-watt technology, Enhanced Peripherals.

Unit-3	**15 Hrs**

Definition and evolutionof theInternet of Things. IoTarchitectureand components. IoT communicationprotocols: MQTT,CoAP, HTTP. IoTapplication domains

Overview of IoT devices: sensors and actuators. Types and characteristics of sensors used in IoT

Introduction to IOT hardware: Arduino ESP and Raspberry pi- Introduction, architecture and programming. Interfacing with sensors and actuators.

Unit-4	**15 Hrs**

Wireless communication technologies for IoT: Wi-Fi, Bluetooth, Zigbee, LoRaWAN, etc.IoT network topologies: star, mesh, and hybrid networks.IoT data management and storage.IoT protocols for device-to-device and device-to-cloud communication.

ReferenceBooks

1.	Muhammad Tahir and KashifJaved, "ARMMicroprocessor Systems:Cortex-MArchitecture, Programming,and Interfacing," 1st Edition, CRC Press, 2017.
2.	KennethJ.Ayala,"The8051Microcontroller",3rd Edition,Thomson/CengageLearning, 1997
3.	MuhammadAli MazidiandJanice GillespieandRollin D, "The 8051 Microcontrollerand Embedded Systems using assembly and C,"1st Edition, Pearson, 2006.
4.	Tim Wilmshurst,"Designing EmbeddedSystems with PIC Microcontrollers: Principles and applications",First Edition, Elsevier, 2007.
5.	MuhammadAliMazidiandRolinD,Mckinlay, "PICMicrocontrollerandEmbeddedSystems using assembly and C for PIC18," 1st Edition, Pearson, 2008.
6.	JohnPitman,"DesignwithPICMicrocontrollers,"1st Edition,PrenticeHall,1997.
7	Internet of Things: Principles and Paradigms by RajkumarBuyya, Amir VahidDastjerdi, and Anton Y. Dongarra.
8	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things by David Hanes, Gonzalo Salgueiro, Patrick Grossetete, and Robert Barton.