THE NATIONAL COLLEGE

AUTONOMOUS

Jayanagar, Bengaluru-70

DEPARTMENT OF ELECTRONICS

I Semester B.S **PAPER I: BS1-ELECT1: ELECTRONIC DEVICES AND CIRCUITS**	
Total Teaching Hours : 56	No. Of Lecture Hours/Week:4
Max Marks:60	

Course Objectives

Upon completing the course, ELE-CT1, the students

1. Will be able to understand variousfundamental principles of network analysis, number systems and Boolean algebraand
2. become familiar with the basic operation of electronic devices and circuits whichare the building blocks of all electronic circuits, devices and gadgets

Course Outcomes

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

CO1: Understand and Analyze DC and AC circuits

CO2: Understand and study the behaviour and I-V characteristics of Semiconductor Diodes and Transistor.

CO3: Applying the standard device models to explain/calculate critical internal parameters of semiconductor devices.

CO4: Understand the working of basic diode circuits and their applications.

CO5: Understand the working of transistor amplifiers

CO 6: Understand various number systems and their arithmetic operations.

CO 7: Understand the working of basic logic gates, concepts of Boolean algebra

.

Content	Hrs
UNIT – 1	14
Chapter No. 1- Electronic Components: Electronic passive and active components, types and their properties, Concept of Voltage and Current Sources, electric energy and power, Power Audit (Qualitative only).	
Chapter No. 2- Network Analysis- Mesh Current Method. **Network Theorems:** Superposition, Thevenin's, and Maximum Power Transfer theorems. DC and AC analysis of RC and RL circuits, RLC series and parallel Resonant Circuits.	
Chapter No. 3- PN junction diode: Ideal and practical diodes, Formation of Depletion Layer, Diode Equation and I-V characteristics. Idea of static and dynamic resistance, Zener diode, Reverse saturation current, Zener and avalanche breakdown.	
Chapter No. 4- Rectifiers: Half wave and Full wave (centre tap and bridge) rectifiers, expressions for output voltage, ripple factor and efficiency (mention only), Shunt capacitor filter. (Numerical examples wherever applicable).	
UNIT – 2	14
Chapter No. 5- Voltage regulator: Block diagram of regulated power supply, Line and Load regulation, Zener diode as voltage regulator – circuit diagram, load and line regulation, disadvantages. Fixed and Variable IC Voltage Regulators (78xx, 79xx, LM317), Clippers (shunt type) and clampers (Qualitative analysis only), Voltage Multipliers.	
Chapter No. 6- Bipolar Junction Transistor: Construction, types, CE,CB and CC configurations (mention only), VI characteristics of a transistor in CE mode, Regions of operation (active, cut off and saturation), leakage currents (mention only), Current gains α , β and γ and their inter-relations, dc load line and Q point. Applications of transistor as amplifier and switch - circuit and working. (Numerical examples wherever applicable).	

UNIT – 3	14
Chapter No. 7- Transistor biasing and Stabilization circuits: Fixed Bias and Voltage Divider Bias. Thermal runaway, stability and stability factor. Transistor as a two-port network, h-parameter equivalent circuit.	
Chapter No. 8- Amplifier: Small signal analysis of single stage CE amplifier using h-parameters. Input and Output impedances, Current and Voltage gains. Advantages of CC amplifier. Class A, B and C Amplifiers (qualitative), Types of coupling, two stage RC Coupled Amplifier – circuit, working and its Frequency Response, GBW product, Darlington transistor.	
Chapter No. 9- Special semiconductor diodes: Varactor diode, Schottky diode, Tunnel diode - construction, characteristics, working, symbol, and applications for each. LED, LCD and solar cell – construction, operation and applications, 7-segment display, concept of common anode and common cathode types (Numerical problems, wherever applicable)	
UNIT – 4	14
Chapter No. 10- Number System: Decimal, Binary, Octal and Hexadecimal number systems, base conversions. Representation of signed and unsigned numbers, **Binary arithmetic**: Addition, Subtraction by 1"s and 2"s complement method, BCD code (8421,2421, Excess-3), Gray code, Error checking and correction codes (Only parity check).	
Chapter No. 11- Boolean Algebra: Constants, variables, operators, basic logic gates-AND, OR, NOT, Positive and negative logic, Boolean laws, Duality Theorem, De'Morgan's Theorems. Derived logic gates (NAND, NOR, XOR & XNOR). Universal property of NOR and NAND gates. (Numerical examples wherever applicable).	

Suggested References

1. Introductory circuit analysis, Robert L Boylestad 5th edition., Universal Book 2003.
2. A Text book of Applied Electronics, R S Sedha, 7th edition., S. Chand and Company Ltd. 2011.
3. Principles of Electronics, A.P. Malvino 7th edition, TMH, 2011.
4. Electronic devices and circuit theory by Boylestad, Robert Nashelsky, 11th Edn., Pearson, 2013
5. Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia, (1994)
6. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Edn., TMH, 2011.
7. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, PHI Learning Pvt. Ltd. 2009
8. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer,PHI Learning, 2001
9. J. Millman and C. C. Halkias, “Integrated Electronics”, Tata McGraw Hill, 2001
10. 2000 Solved Problems in Electronics ,J. J. Cathey, Schaum‟s outline Series, TMG, 1991.

Course Code: **BS1-ELECP1**: **Title: ELECTRONIC DEVICES AND CIRCUITS – PRACTICAL**	Course Credits: 2
Total Contact Hours: 32Hrs	Duration of ESA: 3 Hrs
Formative Assessment Marks: **25 marks**	Summative Assessment Marks: **25 marks**

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 various fields of electronics both in industries and research.
2. To acquire experimental skills, analysing 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 and analyze the problems in various sub disciplines of electronics.
5. Capability to use the Modern Tools / Techniques.

1SELE1P: ELECTRONIC DEVICES AND CIRCUITS – PRACTICAL

(Hardware implementation and Analysis of Circuit using Simulation Software)

Content	Hrs
1. Demonstration Experiments: Hands on Experimental Skills and Familiarization with a) Electronic components b) Resistance in series, parallel and series-parallel c) Capacitors and inductors in series and parallel d) Multimeter and LCR meter – checking of components / measurements. e) Voltage sources in series, parallel and series-parallel f) Voltage and current dividers g) Measurement of Amplitude, Frequency & Phase difference using Oscilloscope	
Part – A (Any FIVE)	16
2. Verification of Thevenin"s and Maximum Power Transfer Theorem. 3. Verification of Superposition Theorem. 4. Study of the I-V Characteristics of (a) P-N junction diode, and (b) Zener diode. 5. Study of the I-V Characteristics of LEDs of two different colours and 7-segment display. 6. Study of Half wave rectifier without and with shunt capacitor filter– ripple factor for differentvalues of filter capacitors. 7. Study of full wave bridge rectifier without and with shunt capacitor filter – ripple factor fordifferent values of filter capacitors. 8. Study of Zener diode as a Voltage Regulator using bridge rectifier with shunt capacitor filter[Load and line regulation]. 9. Study of Clipping, Clamping and Voltage Multiplier circuits. 10. Designing and testing of fixed positive and negative voltage regulators using 78xx and 79xxseries ICs (Using bridge rectifier and shunt capacitor filter). 11. Designing and testing of variable voltage regulator using IC LM317 (Using bridge rectifier andshunt capacitor filter).	

	Part – B (Any FIVE experiments including compulsory experiment No 14)	16
12.	Study of Transistor characteristics in CE configuration – determination of h-parameters.	
13.	Study of Fixed Bias and Voltage divider bias circuits – comparison for different β values.	
14.	Study of single stage CE amplifier (frequency response, input and output impedances in mid-band	
15.	Study of two-stage RC-coupled CE amplifier (A_{V1}, A_{V2}, A_V) at mid-band frequency.	
16.	Study of Series and Parallel Resonance circuits – determination of its (a) Resonant frequency (b) Impedance at resonance (c) Bandwidth (d) Quality Factor	
17.	Verification of truth tables of OR, AND, NOT, NAND, NOR, XOR and XNOR gates usingrespective ICs. Realization of XOR and XNOR using basic gates.	
18.	Universal property of NAND and NOR gates.	
19.	Binary to Gray and Gray to Binary code conversion and parity checker using XOR gates IC7486.	

Course Code: **OE1-ELE1** **Title: DIGITAL COMPUTER ELECTRONICS**	Course Credits: 3
Total Contact Hours: 42 Hrs	Duration of ESA: 3 Hrs
Formative Assessment Marks**: 40 marks**	Summative Assessment Marks: **60 marks**
Model Syllabus Authors:	

Course Outcomes (COs):

Upon the completion of this course, students will demonstrate the ability to:

CO1: Analyze different number systems used in Digital Electronics and simplification of logical expressions

CO2: Analyze the Boolean functions using Boolean algebra and K-map technique .

CO3: Understand Logic circuits.

CO4: Understand Basic Structure of a Digital Computer

CO5: Understand Memories and various input and output devices.

0E1-ELE1– DIGITAL COMPUTER ELECTRONICS

CONTENT	Hrs
UNIT – 1	14
Chapter No 1:Decimal, Binary, Octal and Hexadecimal – their inter conversion. Binary addition, Binary Subtraction, Sign magnitude convention, 1's and 2's Complements-2's Complement Subtraction. Binary Codes-BCD, ASCII codes. **Chapter No 2**:Basic Logic gates-AND, OR and NOT gates (Logic symbols and Truth tables), Boolean Algebra- Laws and Theorems, Positive and Negative Logic. NAND and NOR gates (Logic symbols and Truth tables), De Morgan's theorems, XOR gate, XNOR gate, NAND and NOR as Universal gates. Boolean Expressions, SOP and POS expressions. Boolean Expression for a given truth table.	
UNIT – 2	14

Chapter No 3: Arithmetic Logic Unit, Half Adder, Full Adder and Binary Adder. Encoders: Decimal to BCD Encoders, Priority Encoders.Decoders: BCD – Decimal Decoder. **Chapter No 4:**SR-flip flop , D flip-flop, JK flip-flop, JK Master slave FF, Edge trigger and Level trigger FF, Registers and Shift Registers:, SISO, SIPO, PISO, PIPO Right shift and Left shift. Counters- Synchronous and Asynchronous counters. ripple counters, Synchronous counters, Ring counters.	
UNIT – 3	**14**
Chapter No 5: Structure of Computers: Computer Types, Generation of Computers, Functional units, Von-Neumann Architecture, Complex Instruction Set Computer (CISC),Reduced Instruction Set Computer (RISC), RISC V/S CISC, Bus Structures. Software, Hardware, Compiler. **Chapter No 6: Memories**: Semiconductor Memories ROMS, POMS, EPROMS, EEPROMS, RAM, Static RAM, Dynamic RAM. Concept of Cache memory, Secondary Storage Devices, Hard Disk, CD ROM ,Flash Memory. **Chapter No 7:Input Output Devices:** Memory Mapped I/O, Peripheral mapped I/O Direct memory access. Key Board, Mouse, Printers and Monitor	

Suggested References

1. Digital Computer Electronics: Malvino, Brown- TMH 3rd Edition.
2. Computer Organization: Carl Hamacher and others-McGrawHill 5th Edition
3. Computer Architecture and Organiztion: John P Hayes-McGrawHill 3rd Edition

SECOND SEMESTER

II Semester B.Sc

PAPER I: BS2-ELECT2: ANALOG AND DIGTIAL ELECTRONICS

Total Teaching Hours : 56	No. Of Lecture Hours/Week:4
Max Marks:60	

Course Objectives

Upon completing the course, ELE-CT1, the students

1. Will be able to understand fundamental principles of various Analog circuits
2. Will be able to understand fundamental principles of various Digital circuits

Course Outcomes

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

1. Understand and study the behaviour of the semiconductor devices ie., I-V characteristics of various MOSFET devices the knowledge can be extended for understanding the behaviour /characteristics/ response of unknown / novel devices.
2. Applying the standard device models to explain/calculate critical internal parameters of semiconductor devices.
3. Understanding and characterizing the behaviour of known/unknown/novel power electronic devices such as UJT, SCR, Diac, Triac etc.
4. Acquainting and familiarization of the experimental skills to determine the behaviour of semiconductordevices.
5. Capable of analyzing the device characteristics and responses.
6. Understanding the working of basic logic gates, concepts of Boolean algebra and techniques toreduce/simplify Boolean expressions and their applications.
7. Synthesizing and Analyzing combinatorial and sequential circuits and their applications in electronics.

BS2-ELECT2: ANALOG AND DIGITAL ELECTRONICS

Content	Hrs
UNIT – 1	14
Chapter No. 1- JFET–Types - p-channel and n-channel, working and I-V characteristics - n-channel JFET, parameters and their relationships, Comparison of BJT and JFET.	
Chapter No. 2- MOSFET: E–MOSFET, D–MOSFET – n-channel and p-channel, Construction, working, symbols, biasing, drain and transfer characteristics, MOSFETs handling, MOS logic, symbols and switching action of MOS, CMOS logic, CMOS – inverter, circuit and working, CMOS characteristics.	
Chapter No. 3-UJT: Construction, working, equivalent circuit and I-V characteristics,intrinsic stand-off ratio, Relaxation oscillator.	
Chapter No. 4- SCR: Construction, VI characteristics, working, symbol, and applications – HWR and FWR.	
Chapter No. 5- Diac and Triac: Construction, working, characteristics, applications,(Numerical examples wherever applicable)	
UNIT – 2	14
Chapter No. 6- Op-Amp: Differential Amplifier, Block diagram of Op-Amp, Characteristics of an Ideal and Practical Op-Amp, Open and closed loop configuration, Frequency Response, CMRR, Slew Rate and concept of Virtual Ground.	
Chapter No. 7- Applications of op-amps: Concept of feedback, negative and positive feedback, advantages of negative feedback (Qualitative Study). Inverting and non-inverting amplifiers, Summing and Difference Amplifier, Differentiator, Integrator, Comparator and Zero-crossing detector.	
Chapter No. 8-Filters: First order active Low pass, High pass and Band pass,All pas Butterworth filters.	
Chapter No. 9-Oscillators: Barkhausen criterion for sustained oscillations, Colpitt‟s oscillator and crystal oscillators using transistor, Phase Shift oscillator, Wien-bridgeoscillator – (no derivation for each)	
Chapter No. 10-IC 555 Timer: Introduction, Block diagram, Astable and Monostable multivibrator circuits. (Numerical Examples wherever applicable)	
UNIT – 3	14

Chapter No. 11- Logic Families: Pulse characteristics, Logic Families-classification ofdigital ICs. Characteristics of logic families, circuit description of TTL NAND gate with totem pole and open collector. TTL IC terminology. CMOS NAND, Comparison of TTLand CMOS families.	
Chapter No. 12- Combinational Logic Circuits: Minimisation techniques using K-maps - SOP and POS, Minterm, Maxterm, SSOP, SPOS, Simplification of Boolean expressions, K-Map for 3 and 4 variables.	
Chapter No. 13- Digital to Analog Converter: DAC with binary weighted resistor and R-2R resistor ladder network. Analog to Digital converter: Successive approximation method-performance characteristics.	
Chapter No. 14- Design of Arithmetic Logic Circuits: Half Adder, Full Adder, Half Subtractor. 4-bit parallel binary adder, 2-bit and 4-bitmagnitude comparator. Encoder, decimal to BCD priority encoder. Decoder, 2:4 decoder using AND gates, BCD to decimal decoder, BCD to 7- Segment decoder, Multiplexer - 4:1 and 8:1 multiplexer, Demultiplexer - 1:4 and 1:8 demultiplexer (logic diagram and truth table of each).	
UNIT – 4	14
Chapter No. 15- Sequential Logic Circuits: Flip-Flops - SR Latch, RS, D and JK Flip- Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. Master- Slave JK and T Flip-Flops. Applications of Flip-Flops in semiconductor memories, RAM, ROM and types.	
Chapter No. 16- Registers and Counters: Types of Shift Registers, Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits), applications. Ring counter, Johnson counter applications. Asynchronous Counters: Logic diagram, Truth table and timing diagrams of 4bit ripple counter, modulo-n counters,4 bit Up-Down counter, Synchronous Counter: 4-bit counter, Design of Mod 3, Mod 5 and decade Counters using K-maps.	

Suggested References:

1. Electronic Devices Thomas L. Floyd, 10th edition, Pearson,2018.
2. Electronic devices and circuit theory by Boylestad, Robert Nashelsky, 11thEdn., Pearson, 2013
3. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edn., Prentice Hall., 2000
4. Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, Oxford University Press. 2011,

5. A Text book of Applied Electronics, R S Sedha 7th edn., S Chand and Company Ltd., 2011
6. Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia, 1994
7. Digital Principles and Applications, A.P. Malvino, D P Leach and Saha, 7th Edition, TMH, 2011.
8. Fundamentals of Digital Circuits, Anand Kumar, 2ndEdn, PHI Learning Pvt. Ltd. 2009
9. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, PHI Learning. 2001
10. Digital Principles, Schaum‟s Outline Series, R. L. Tokheim, TMH., 1994

Course Code: **BS2-ELECP2**: **Title:ANALOG AND DIGITAL ELECTRONICS - PRACTICAL**	Course Credits: 2
Total Contact Hours: 32 Hrs	Duration of ESA: 3 Hrs
Formative Assessment Marks: **25 marks**	Summative Assessment Marks: **25 marks**
Model Syllabus Authors:	

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 various fields of electronics both in industries and research.
2. To acquire experimental skills, analysing 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 and analyze the problems in various sub disciplines of electronics.
5. Capability to use the Modern Tools / Techniques.

BS2-ELECP2: ANALOG AND DIGITAL ELECTRONICS - PRACTICAL

(Hardware and Circuit Simulation Software)

	Content	Hrs
	Minimum FIVE Experiments to be performed in each Part	
	PART - A (Any FIVE)	16
1.	Study of JFET/MOSFET characteristics – determination of parameters.	
2.	UJT characteristics and relaxation oscillator	
3.	SCR characteristics – determination of I_H and firing voltage for different gate currents.	
4.	Design of inverting and non-inverting amplifier using Op-amp & study of frequency response.	
5.	Op-amp inverting and non-inverting adder, subtractor and averaging amplifier.	
6.	Design and study of differentiator and integrator using op-amp for different input waveforms.	
7.	Design and study of Wien bridge and RC phase shift oscillator using op-amp.	
8.	Design and study of first order high-pass and low-pass filters using op-amp.	
9.	Study of Colpitt‟s and crystal oscillator using transistor.	
10.	A stable and Mono stable multivibrators using IC-555 timer.	
	PART – B (Any FIVE)	16
1.	Realiation of NOT, AND, OR, NOR, XOR And XNOR gates using IC 7400 and 7402	
2.	Half Adder and Full Adder , Half Subtractor using (a) logic gates (b) using only NAND gates.	
3.	4 bit parallel binary adder and Subtractor using IC7485.	
4.	Study of BCD to decimal decoder using IC7447	
5.	Study of the Encoders and priority encoders.	
6.	Study of Multiplexer and Demultiplexer using ICs.	
7.	Study of 2-bit and 4-bit magnitude comparators.	
8.	Study of Clocked RS, D and JK Flip-Flops using NAND gates.	
9.	Study of 4-bit asynchronous counter using JK Flip-Flop IC7476, modify to decade counter and study their timing diagrams.	
10.	Digital to Analog converter using binary weighted resistor method, determination of resolution, accuracy and linearity error.	

Course Code: **OE2-ELE2** **Title:CONSUMER ELECTRONICS**	Course Credits: 3
Total Contact Hours: 42Hrs	Duration of ESA: 3 Hrs
Formative Assessment Marks: **40 marks**	Summative Assessment Marks: **60 marks**

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 various fields of electronics both in industries and research.
2. To acquire experimental skills, analysing 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 and analyze the problems in various sub disciplines of electronics.
5. Capability to use the Modern Tools / Techniques.

2ELEOE 2.1: CONSUMER ELECTRONICS

Content	Hrs
UNIT – 1	10
Chapter No. 1- Audio Systems: PA system, Microphones, Amplifier, Loudspeakers, Radio Receivers, AM/FM, Audio Recording, and reproduction, Installation of Audio/Video systems – site preparation, electrical requirements, cables and connectors. Study of PA systems for various situations – Public gathering, Closed theatre / Auditorium, Conference room, Prepare bill of material (Costing)	
UNIT – 2	10
Chapter No. 2- TV and Displays: set top box, CATV and Dish TV, LCD, Plasma, LED, OLED, QDLED and LED TV, Projectors: DLP, Home Theatres, Remote controls.	
UNIT – 3	10
Chapter No. 3- Landline and Mobile Telephony: Mobile Phones, Smart Phone, Smart Watch, GPRS and Bluetooth, GPS Navigation system. Office Equipment: Scanners, Barcode / flat bed, printers, Xerox, Multifunction UNITs (Print, Scan, and copy)	
UNIT – 4	12
Chapter No. 4- Electronic gadgets and Domestic Appliances: Digital Clock, Digital Camera, Handicam, Home security system, CCTV, Air conditioners, Refrigerators, washing machine / Dish washer, Microwave oven, Vacuum cleaners. **Chapter No. 5-** Identification of block and tracing the system, Assembly and Disassembly of system using toolkit.	

Suggested References:

1. Consumer Electronics, R.P.Bali, Pearson Education, 2008
2. R Audio and Video systems, G. Gupta, Tata McGraw Hill, 2004
3. 3D Flat Panel – Practical tool for self-assessment., TVs and Displays, Gerardus Blokdyk., edition,2018
4. Basic TV Technology – Digital and Analog, Robert L Harwing., 4th Edition, Routhledge, 2012.
5. The TVs of Tomorrow: How RCA‟s Flat-Screen Dreams Led to the First LCDs (Synthesis),Benjamin Gross., Illustrated edition, University of Chicago Press; 2018
6. OLED Display – Fundamentals and Applications., TakatoshiTsujimura., Willey, 2012