8. Computer Fundamentals - Peter Norton, McGraw-Hill Education
9. Walter C.Bosshart "PCB Design and Technology" Tata McGraw Hill, Publications, Delhi. 1983.
10. Clyde F.Coombs "Printed circuits Handbook" IIIEdition McGrawhill Kraig Mitzner, "Complete PCB Design Using OrCAD Capture and Layout," Elsevier, Amsterdam,
11. Walter C Bosshart, "Printed Circuit Board Design and Technology",1st ed., McGraw Hill Education

Semester II

ELE-CT2: ANALOG AND DIGITAL ELECTRONICS

(Credits: Theory – 04, Practical – 02) Total Teaching hours: 60

Course Objectives

Upon completing the syllabus contents of ELE-CT2, the student will become familiar with various working principles of widely used electronic devices, linear and digital ICs which help the students to build small projects and also be able to answer some basic questions that appear in competitive examinations.

UNIT-1 **15 HOURS**

JFET–Types - p-channel and n-channel, working and I-V characteristics - n-channel JFET, parameters and their relationships, Comparison of BJT and JFET.

MOSFET:E – MOSFET, D – MOSFET – n-channel and p-channel, Construction, working, symbols, biasing, drain and transfer characteristics, VMOS, UMOS Power MOSFETs, handling, MOS logic, symbols and switching action of MOS, NMOS inverter, CMOS logic, CMOS – inverter, circuit and working, CMOS characteristics, IGBT construction and working.

UJT - basic construction, working, equivalent circuit and I-V characteristics,intrinsic stand-off ratio, relaxation oscillator.

SCR - Construction, VI characteristics, working, symbol, and applications – HWR and FWR.

Diac and Triac-construction, working, characteristics, applications, (Numerical examples wherever applicable)

UNIT-2 **15 HOURS**

Op-Amp: Differential Amplifier, Block diagram of Op-Amp, Characteristics of an Ideal and PracticalOp-Amp, Open and closed loop configuration, Frequency Response, CMRR, Slew Rate and concept of Virtual Ground.

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

Filters: First and second order active low pass, high pass and bandpass Butterworth filters.

Oscillators: Barkhausen criterion for sustained oscillations, Colpitt's oscillator and crystal oscillators using transistor, Phase Shift oscillator,Wien-bridge oscillator – (no derivation for each)

IC 555Timer: Introduction, Block diagram, Astable and Monostable multivibrator circuits. (Numerical Examples wherever applicable)

UNIT-3 **15 HOURS**

Logic Families: Pulse characteristics, Logic Families-classification of digital ICs. Characteristics of logic families, circuit description of TTL NAND gate with totem pole and open collector. TTL IC terminology. CMOS NAND, comparison of TTL and CMOS families.

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 variable.

Digital to Analog converter- DAC with binary weighted resistor and R-2R resistor ladder network. Analog to Digital converter: Successive approximation method-performance characteristics.

Design of Arithmetic logic circuits:Half Adder, Full Adder, Half Subtractor, Full 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, 3:8 decoder using NAND 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, Realization of Full adder and Full subtractor using Mux and Decoder.

UNIT 4 **15 HOURS**

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.

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 4 bit ripple counter, modulo-n counters,4bit Up-Down counter, Synchronous Counter: 4-bit counter, Design of Mod 3, Mod 5 and decade Counters using K-maps.

Course Outcomes

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

- Reproduce the I-V characteristics of various MOSFET devices,
- Apply standard device models to explain/calculate critical internal parameters ofsemiconductor devices.
- Explain the behavior and characteristics of power devices such as UJT, SCR, Diac, Triac etc.
- Perform experiments for studying the behavior of semiconductor devices.
- Calculate various device parameters' values from their IV characteristics.
- Interpret the experimental data for better understanding the device behaviour.
- Understand basic logic gates, concepts of Boolean algebra and techniques toreduce/simplify Boolean expressions
- Analyze combinatorial and sequential circuits

Reference Books:

(1) Electronic devices and circuit theory by Boylestad, Robert Nashelsky

(2) Electronic Devices Conventional Current Version by Thomas L. Floyd

(3) David A. Bell " Electronic Devices and Circuits", 5th Edition, Oxford Uni. Press, 2015

(4) OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edn, 2000, Prentice Hall

(5) Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, 2011,

Oxford University Press.
(6) R.S.Sedha, "A Text book of Applied Electronics", 7th edition.,S.Chand and Company Ltd. 2011
(7) Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia (1994)
(8) Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011, Tata McGraw
(9) Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
(10) Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
(11) Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning.
(12) R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
(13) Digital Electronics, S.K. Mandal, 2010, 1st edition, McGraw Hill

ELE-CP2: ANALOG AND DIGITAL ELECTRONICS - Lab

(Hardware and Circuit Simulation Software)

PART A (Any FIVE)

1. Study of JFET/MOSFET characteristics – determination of parameters.
2. Study of single stage JFET amplifier.(frequency response and band width)
3. UJT characteristics and relaxation oscillator
4. SCR characteristics – determination of I_H and firing voltage for different gate currents.
5. Design of inverting and non-inverting amplifier using Op-amp & study of frequency response.
6. Op-amp inverting and non-inverting adder,subtractorand averaging amplifier.
7. Study of the zero-crossing detector and comparator.
8. Design and study of differentiator and integrator using op-amp for different input waveforms.
9. Design and study of Wien bridgeand RC phase shift oscillator using op-amp.
10. Design and study of first order high-pass and low-pass filters using op-amp.
11. Study of Colpitt's and crystal oscillator using transistor.
12. Astablemultivibrator using IC555 timer.

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13. Monostable multivibrator using IC555 timer.

PART B (Any SEVEN)

14. Half Adderand Full Adder using (a) logic gates (b) using only NAND gates.
15. HalfSubtractor and Full Subtractor(a) logic gates (b) using only NAND gates.
16. 4 bit parallel binary adder and subtractor using IC7485.
17. Study of BCD to decimal decoder using IC7447
18. Study of the Encoders and priority encoders.
19. Study of Multiplexer and Demultiplexer using ICs.
20. Study of 2-bit and 4-bit magnitude comparators.
21. Study of Clocked RS, D and JKFlip-Flops using NAND gates.
22. Study of 4-bit asynchronous counter using JK Flip-Flop IC7476, modify to decade counter and study their timing diagrams.
23. Study of 4-bit Shift Register – SISO, modification to ring counter using IC 7495.
24. Digital to Analog converter using binary weighted resistor method, determination of resolution, accuracy and linearity error.

ELE-OE2.1: Consumer Electronics

(Credits: Theory – 02, Demonstration Lab– 01) Total Teaching hours: 60

Unit – 1

Audio Systems: PA system, Microphones, Amplifier, Loudspeakers, Radio Receivers, AM/FM, Audio Recording, and reproduction, Cassettes, CD and MP3.

Unit – 2

TV and Video Systems: Television standards, BW/Colour, CRT/HDTV, video system, VCR/VCD/DVD players, MP4 players, set top box, CATV and Dish TV, LCD, Plasma and LED TV, Projectors: DLP, Home Theatres, Remote controls.

Unit – 3

Landline and Mobile Telephony: Basic landline equipment, CL1, cordless intercom/EPABX system, mobile phones: GPRS and Bluetooth, GPS Navigation system, smart phones, Office Equipment: Scanners, Barcode / flat bed, printers,

Xerox, Multifunction units (Print, Scan, fax, and copy)

Unit – 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.

Suggested Books:

1. R.P.Bali, Consumer Electronics, Pearson Education (2008)
2. R.G. Gupta, Audio and Video systems, Tata McGraw Hill (2004)

Consumer Electronics Lab:

1. Study of PA systems for various situations – Public gathering, Closed theatre / Auditorium, Conference room, Prepare bill of material (Costing)
2. Installation of Audio/Video systems – site preparation, electrical requirements, cables and connectors
3. Market survey of products (at least one from each module)
4. Identification of block and tracing the system, Assembly and Disassembly of system using toolkit.

ELE-OE 2.2: Electronics For Everyone

(Credits: Theory – 02, Demonstration Lab– 01) Total Teaching hours: 60

Unit-1

Timer and PLL: Functional block diagram of 555 timer, Monostable operation and its Application, Astable operation and its Applications,

Phase Locked Loop: Functional block diagram – Phase detector / Comparator, Voltage Controlled Oscillator, Low pass filter, Applications: Frequency multiplier/ Division, AM detection

Unit-2

Operational Amplifier: Inverting and non-inverting amplifier, Op-amp parameters, Summing Amplifier, Difference Amplifier, Integrator, Differentiator, Instrumentation Amplifier, Audio Amplifier(LM386), Voltage to current converter, Current to Voltage converter, Sample and Hold circuits.

First order active filters (Circuit diagram and formula only): low pass, high pass, band pass, band reject and all pass filters. Phase-shift and Wein bridge oscillator using op-amp.

Unit-3

Transducers (Basic Working): Displacement transducers - Resistive (Potentiometric, Strain Gauges – Types, Gauge Factor, bridge circuits, Semi-conductor strain gauge) Capacitive (diaphragm), Hall effect sensors, magneto-strictive transducers, Microphone, Touch Switch, Piezoelectric sensors, light(photo-conductive, photo emissive, photo voltaic, semiconductor, LDR), Temperature(electrical and non-electrical), Pressure sensor.

A-D and D-A Conversion: D-A conversion: 4 bit binary weighted resistor type, circuit and working. Circuit of R-2R ladder- Basic concept.A-D conversion characteristics, successive approximation ADC. (Mention the relevant ICs for all).

Unit-4

Data Acquisition using Arduino: Arduino: Birth, Open Source community, Functional Block Diagram, Functions of each Pin, Arduino Development Boards: IDE, I/O Functions, Looping Techniques, Decision Making Techniques, Designing of 1st sketch, Programming of an Arduino (Arduino ISP) , Serial port Interfacing, Basic Interfacing and I/O Concept, Interfacing LED,Switch,7seg LED, different sensors.

Suggested Books:

1. B. C. Sarkar and S. Sarkar, Analog Electronics: Devices and Circuits (Revised edition), Damodar Group (Publishers),Burdwan, ISBN: 978-93-85775-15-4 (2019)
2. Measurement Systems, 4/e, Doeblin McGraw Hill, New York, 1992.
3. Electrical Measurements & Electronic Measurements by A.K. Sawhney
4. B. C. Sarkar and S. Sarkar, Digital Electronics: Circuits and Systems, S U T Prakashani ,Burdwan, ISBN:978-81-88391-57-8 (2018)

5. Instrumentation- Devices and Systems ByRangan, Sarma, and Mani, Tata-McGrawHill
6. Electronic Instrumentation by H.S Kalsi, McGraw Hill
7. Instrumentation measurements and analysis by Nakra&Choudhary
6. Measurement & Instrumentation- DVS Murthy
7. R. A. Gayakwad, Op-Amps and Linear IC's, Pearson Education (2003)
8. Electronic Sensor Circuits and Projects, III Volume, Forrest M Mims, Master Publishing Inc.
9. Timer, Op Amp, and Optoelectronic Circuits & Projects, Forrest M Mims, Master Publishing Inc.
10. Exploring Arduino, Jeremy Blum, Wiley
11. Beginning Arduino, Michael McRobetrs, Technology in Action
12. Beginning Arduino Programming, Brian Evans ,Technology in Action
13. Practical Arduino Engineering, Harold Timmis, Technology in Action
14. Practical Arduino : Cool Projects for open source hardware, Jonathan Oxer, Hugh Blemings, Technology in Action

Electronics For Everyone Demonstration Lab

(Hardware and Circuit Simulation Software) **30 hours**

1. Study of basic monostable multivibrator
2. Study of basic Astable multivibrator
3. Light detection using 555 timer
4. Rain alarm using 555 timer
5. Motor control by PWM using 555 timer
6. LED flasher circuit using 555 timer
7. Analog light wave Transmitter/Receiver using 555 timer
8. Study of basic inverting and non-inverting amplifier
9. Study of basic integrator circuit
10. Study of basic differentiator circuit
11. Design of first order LPF
12. Study of first order HPF
13. Designing of fiber optic based Transmitter /Receiver using LM386
14. Temperature to voltage converter using 741.
15. Shadow sensing using 741
16. Light based PWM using 741 and V-F converter
17. Test the different Arduino Boards, Open-Source and Arduino Shields.
18. Install Arduino IDE and its development tool.

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19. Develop a program to Blink LED for 1second.
20. Develop a program to interface Input Switches and output LEDs with development board (arduino).
21. Interface 7 segment display with development board (arduino)
22. Interface LM35 temperature sensor with arduino and monitor temperature on serial monitor.
23. Interface DC motor using L293D Motor Driver.
24. Interfacing of various sensors with arduino development board

ELE-OE 2.3: Mobile Communication

(Credits: Theory – 02, Demonstration Lab– 01) Total Teaching hours: 60

Unit 1

Evolution of mobile radio communication-Examples of wireless communication system: paging systems, cordless telephone system, cellular telephone system-Trends in cellular radio and personal communication systems

Unit 2

Frequencies for radio transmission- Basics of multiplexing and multiple access techniques-CDMA-Cellular system concepts- Frequency reuse- Channel assignment and handoff strategies- Improving capacity in cellular system: cell splitting, sectoring, repeaters for range extension, a microcell zone concept.

Unit 3

Introduction to telecommunicating system- GSM: mobile services (Bearer services, tele-services, supplementary services), system architecture (radio subsystem, network and switching subsystem, operation sub system)

Unit 4

Satellite system: history, application, basics, routing, localization and handover-Broadcast system: digital audio broadcasting, digital video broadcasting (basic concepts).

Unit 5

Wireless LAN-Infrared vs radio transmission- Bluetooth: user scenarios and architecture- Wimax: basic concepts and features- Wi-Fi - basic concepts.

Mobile Communication – Demonstration Lab **30 hours**

1. Demonstration of keypad mobile handset
2. Demonstration of smartphone handset
3. Block diagram description

Text Books

1. Rapapport T. S, 'Wireless Communication Principles and Practices', Pearson Education
Asia, New Delhi, 3rd Ed.2003.
2. JochenSchiller,'Mobile communication 'Pearson Education,Asia.

Reference Book

Vijay K Garg, Joseph E Wilkes,' Principles and Applications of GSM', Pearson Edu.

ELE-OE 2.4: Mobile Application Programming

(Credits: Theory – 02, Demonstration Lab– 01) Total Teaching hours: 60

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 Android,Tools and about Android SDK, Installing Java, Eclipse, and Android, Android SoftwareDevelopment Kit for Eclipse, Android Development Tool: Android Tools for Eclipse, 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, TheValues Folder, Leveraging Android XML, Screen Sizes, Launching Your Application: TheAndroidManifest.xml File, Creating Your First Android Application.
Android Framework Overview: The Foundation of OOP, The APK File, AndroidApplicationComponents, Android Activities: Defining the User Interface, **Android Services:** Processing in the Background, Broadcast Receivers:

Announcements and Notifications,Content Providers: DataManagement, Android Intent Objects: Messaging for Components,Android Manifest XML:Declaring Your Components.

Views and Layouts, Buttons, Menus, and Dialogs, Graphics Resources in Android:

Introducing the Drawable, Implementing Images, Core Drawable Subclasses, Using Bitmap, PNG, JPEG and GIF Images in Android, Creating Animation in Android.

Handling User Interface(UI) Events: An Overview of UI Events in Android, Listening forand Handling Events , Handling UI Events via the View Class, Event call back methods, Handling Click Events, Touch screen Events, Keyboard Events, Context Menus, Controlling theFocus.

Content Providers: An Overview of Android Content Providers, Defining a Content Provider,Working with a Database.

Intents and Intent Filters: Intent, Implicit Intents and Explicit Intents, Intents with Activities, Intents with Broadcast Receivers

Advanced Android: New Features in Android 4.4.

iOS Development Environment: Overview of iOS, iOS Layers, Introduction to iOSapplication development.

Windows phone Environment: Overview of windows phone and its platform, Buildingwindows phone application.

Mobile Application Programming – Demonstration Lab **30 hours**

Suggested 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

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To,
Shri Kumar Naik, IAS
The Additional Chief Secretary
Government of Karnataka.
Department of Higher Education,
M.S.Building, Bengaluru – 01

Sir,

Sub: Submission of Draft Model Curriculum and Program Structure of B.Sc. with Electronics under NEP 2020 – reg.

Ref: G.O. No.: ED 260 UNE 2019 (PART I) Bangalore, Dated: 07.08.2021 and 13.08.2021

With reference to the above cited subject and vide reference, I am hereby submitting the Draft Model Curriculum and Program Structure of B.Sc. with Electronics under NEP 2020 as per the guidelines mentioned in the reference.

Thanking you,

Yours sincerely,

Prof. S.V.Halse,
Vice Chancellor,
Davanagere University and
Chairperson of state level expert committee,
Electronics curriculum under NEP2020.

Copy to:

1. Prof. B.ThimmeGowda, Vice Chairman, KSHEC, Bangalore-09
2. Prof. Gopalkrishna Joshi, Executive Director, KSHEC, Bangalore-09.

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