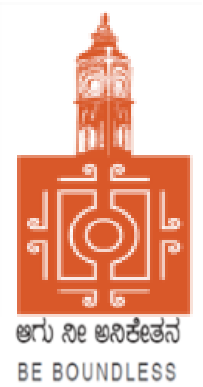

BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM

(Semester Scheme with Multiple Entry and Exit Options for Under Graduate Course- as per NEP 2020)

Syllabus for B.Sc. Electronics
(III & IV Semester)

2022-23 onwards

Contents

ಬೆಂಗಳೂರು ನಗರ ವಿಶ್ವವಿದ್ಯಾಲಯ
BENGALURU CITY UNIVERSITY

Central College Campus, Bengaluru-560 001.

Proceedings of the BoS in Electronics (UG).

Proceedings of the Board of studies (BoS) in Electronics (UG) meeting held on September 15th & 16th 2022 in the Department of Electronic Science, Jnana Bharathi Campus, Bangalore University, Bengaluru-560056.

The Members were present for the meeting are;

Sl No.	Name	Designation	Signature
1.	Dr. J T Devaraju, Registrar (Evaluation), Bangalore University, Bengaluru. Professor, Department of Electronic Science, Bangalore University, Bengaluru – 560056	Chairman	
2.	Sri. K M Thipperudra Swamy Associate Professor, Department of Electronics, Vivekananda Degree College, Bengaluru – 560055	Member	
3.	Sri. S M Mruthunjaya Swamy Associate Professor, Department of Electronics, Vijaya College, R V Road, Bengaluru – 560004	Member	
4.	Sri. S Sanjeev Associate Professor, Department of Electronics, Vijaya College, Jayanagar, Bengaluru – 560011	Member	
5.	Dr. H J Thontadharya Associate Professor, Department of Electronics, Vijaya College, R V Road, Bengaluru – 560004	Member	
6.	Sri. K G Lakshminarayana Associate Professor, Department of Electronics, Vijaya College, Jayanagar, Bengaluru – 560011	Member	
7.	Smt. Rajashri Padaki Associate Professor, Department of Electronics, Seshadripuram First Grade College, Yelahanka New town, Bengalure-560064	Member	
8.	Dr. Mohana H K Assistant Professor, Department of Electronics, Seshadripuram First Grade College, Yelahanka New town, Bengaluru -560064	Member	
9.	Dr Ravi Kolarkar G Associate Professor, Department of Electronics, Nrupathunga University,Bengaluru -560001	Member	
10	Dr. Bharathi Assistant Professor, Department of Electronics, Maharani Cluster University, Bengaluru -560001	Member	-Absent-
11	Sri. Vijaya Kumar A Patil Associate Professor, Department of Electronics, Basaveshwara College of Commerce, Arts and Science, Bengaluru -560010	Co-opted Member	
12	Dr. M Subrayamanya Bhat Associate Professor, Department of Electronics, Vijaya College, R V Road, Bengaluru – 560004	Member Convener	

The Chairman extended warm welcome to all the BoS Members and thanked them for accepting the assignment.

Resolutions:

1. The board prepared 3rd & 4th Semester BSc (Basic) / BSc (Hons.) NEP-2020 Syllabus (2021-22 & onwards) for both theory & practicals, with slight modifications in the state committee syllabus and it was unanimously approved after deliberations.

2. The board also discussed & approved that subjects in SEC (Skill Enhancement Courses) like Digital Fluency, Artificial Intelligence, Cyber Security, Robotics, IoT, etc,. for all the faculties under NEP 2020 can be taught by *Electronics Faculty Members* as they have more exposure to these subjects.

3. The Scheme of awarding marks for Theory, Practical as well as Internal Assessment (IA) was discussed and approved.

4. It was resolved that, number of students for practical's shall be 10 (Ten) per batch per teacher.

5. It was also resolved that, contents of 1st and 2nd semester B.Sc NEP syllabus can be modified in the next academic year .

6. The board also Prepared & approved the Panel of Examiners for the academic year 2022-23

7. Constitution and Approved the BoE in Electronics (UG) for the academic year 2022-23

Finally, the Chairman extended vote of thanks to all BoS members for their active participation.

Chairman

APPENDIX-1: COURSE PATTERN AND SCHEME OF EXAMINATION for B.Sc. (Basic) / B.Sc. (Hons.) as per NEP (2021-22 and onwards)

SUBJECT: ELECTRONICS

Sl. No.	Semester	Title of the Paper	Teaching Hours	Hours / week		Examination Pattern Max. & Min. Marks /Paper						Duration of Exam (hours)		Total Marks / paper	Credits	
						Theory			Practical							
				Theory	Practical	Max.	Min.	IA	Max.	Min.	IA	Theory	Practical		Theory	Practical
1	**III**	**ELE-CT3:** Programming in C and Digital design using Verilog	**56**	**4**	**4**	**60**	**21**	**40**	**25**	**10**	**25**	**2.5**	**4**	**150**	**4**	**2**
		ELE-OE 3.1 / 3.2 / 3.3/ 3.4/ 3.5/ 3.6	**45**	**3**	**-**	**60**	**21**	**40**	**-**	**-**	**-**	**2.5**	**-**	**100**	**3**	**-**
2	**IV**	**ELE-CT4:** Electronic Communication - I	**56**	**4**	**4**	**60**	**21**	**40**	**25**	**10**	**25**	**2.5**	**4**	**150**	**4**	**2**
		ELE-OE 4.1 / 4.2 / 4.3 / 4.4/4.5/4.6	**45**	**3**	**-**	**60**	**21**	**40**	**-**	**-**	**-**	**2.5**	**-**	**100**	**3**	**-**

Scheme of Internal Assessment Marks: Theory

Sl. No.	Particulars	IA Marks
1	Attendance	**10**
2	Internal Tests (Minimum of Two)	**20**
3	Assignments /Seminar / Case Study / Project work / Reports on - visits to industries/exhibitions/science centres / active participation in Electronics competitions, etc.	**10**
	TOTAL Theory IA Marks	**40**

Practicals:

Sl. No.	Particulars	IA Marks
1	Practical Test	**05**
2	Report on datasheet of electronic devices / Seminar on electronics experiments, etc.	**10**
3	Active participation in practical classes	**10**
	TOTAL Practical IA Marks	**25**

APPENDIX- 2: Syllabus

Semester- III

ELE-CT3: PROGRAMMING IN C AND DIGITAL DESIGN USING VERILOG

(Credits: Theory – 04, Practical – 02) **Total Teaching: 56 hours**

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

- Gain the knowledge of programming the system using C programming language.
- The ability to code and simulate any digital function in Verilog HDL.
- Know the difference between synthesizable and non-synthesizable code.
- Understand library modeling, behavioural code and the differences between simulator algorithms and logic verification using Verilog simulation.
- Learn good coding techniques required for current industrial practices.

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1. Write and execute and debug C codes for solving problems.
CO2. Apply the acquired knowledge of digital circuits in different levels of modeling using Verilog HDL.
CO3. Apply the acquired knowledge of digital circuits in different levels of modeling using Verilog HDL.
CO4. Design and verify the functionality of digital circuit/system using test benches.
CO5. Develop the programs more effectively using directives, Verilog tasks and constructs.
CO6. Design and analyse algorithms for solving simple problems.

UNIT 1 **14 hours**

Introduction to C Programming

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.

Input output statement – sprintf(), scanf() and getch(), and math library functions.

Decision making, branching, and looping: if, if-else, else-if, switch statement, break, for loop, while loopand do loop. string related library functions.

UNIT 2 **14 hours**

Arrays: Basics of arrays, declaration, accessing elements, storing elements, two-dimensional and multi-dimensional arrays.

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

Pointers: Pointer declaration, assigning values to pointers, pointer arithmetic, array names used as pointers, pointers used as arrays, pointers and text strings, pointers as function parameters.

Structures: Structure type declarations, structure declarations, referencing structure members, referencing whole structures, initialization of structures, structure bit fields

Unit 3 **16 hours**

Introduction to Verilog

A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and Verilog Introduction to Simulation and Synthesis Tools, Test Benches.

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

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

Expressions: Operands, Operators, types of Expressions

Gate level modeling - Introduction, built in Primitive Gates, multiple input gates, Tri-state gates, pull gates, MOS switches, bidirectional switches, gate delay, array instances, implicit nets, Illustrative Examples (both combinational and sequential logic circuits).

Unit 4 **12 hours**

Data flow Modeling and Behavioral Modeling

Data flow Modeling: Continuous assignment, net declaration assignments, delays, net delays and examples.

Behavioral Modeling: Procedural constructs, timing controls, block statement, procedural assignments, conditional statement, loop statement, procedural continuous assignment, Illustrative Examples

Suggested Learning Resources

TEXT BOOKS:

1) E. Balaguru swamy, "Computing fundamentals and C programming", 4th, Edition, TMH,2008.
2) E. Balaguru swamy, "Programming in ANSI C", 2nd Edition.TMH, 2010.
3) Samir Palnitkar, "Verilog HDL: A guide to digital design and synthesis", Pearson, 2nd edition,2006.
4) J Bhasker, "A Verilog HDL Primer", 3rd Edition, BS Publications,2008.
5) Nazesh M Botros, "HDL programming VHDL and Verilog". Dream tech press, 2009 reprint.

REFERENCE BOOKS:

1) Yashavant Kanetkar, "Let us C", 18th edition, BPB Publications, 2021.
2) T Jayapoovan, "A first course in Programming with C" Vikas Publishing Pvt Ltd,2004
3) Michael D Ciletti, "Advanced Digital Design with the Verilog HDL", person , 2nd edition.
4) Padmanabhan, Tripura Sundari, "Design through Verilog HDL." Wieley, 2016.
5) Cyril P.R., "Fundamentals of HDL", Pearson/sanguine 2010.
6) Donald E. Thomas, Philip R. Moor by, "The Verilog Hardware description language", Springer Science, 5th edition.

Semester - III

ELE DSC-P3: PROGRAMMING IN C & DIGITAL DESIGN USING VERILOG - LAB

Section – A: C – Programming: (Minimum "FIVE" programs to be executed)

1) Programme to generate Fibonacci series upto n elements.
3) Programme to read three numbers and find the biggest (using nested-if).
4) Programme to calculate factorial of a given number.
5) Programme to read percentage of marks and to display appropriate message.
6) Programme to arrange the numbers in ascending order.
7) Programme to generate n-prime numbers.
8) Programme to find roots of quadratic equation (Demonstration of switch case statement).
9) Programme to find the sum & difference of two matrices of order MxN and PxQ.
10) Programme to find the product of two matrices of order MxN and PxQ.
11) Programme to find the sum of principle and secondary diagonal elements of the given MxN
12) Programme to find the transpose of given MxN matrix.

Section B: Digital Design Using Verilog with FPGA kit (Minimum Five programmes is to be written and executed)

1) Realisation of gates using Verilog code.
2) Realize Adder/Subtractor (Full/Half) circuits using Verilog data flow description.
3) Realize the following code converters using Verilog behavioral description.
   a) Gray to Binary and Vice – Versa.
   b) Binary to excess 3 and vice-versa.
4) To realize 4-bit ALU using Verilog programme.
5) To realize using Verilog behavioral description : 8:1 multiplexer, 8:3 encoder.
6) To realize using Verilog behavioral description: 1:8 Demultiplexer, 3:8 decoder.
7) To realize using Verilog behavioral description flip flops:
   (a) D-type (b) JK - type (c) T-type.
8) To realize counters: Up/down (BCD & Binary) using Verilog behavioral description.

Note: It is suggested to carry out **One mini project** for awarding practical IA marks

ELE-OE 3.1: Renewable Energy and Energy Harvesting

Credits: 03 **Total Teaching: 45 hours**

Unit-1 **25 Hours**

Fossil fuels and Alternate Sources of energy: Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models, equivalent circuits, and sun tracking systems.

Wind Energy harvesting**:** Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

Demonstration Experiments: 1. Demonstration of training modules on solar energy, wind energy etc.

Unit – 2 **20 Hours**

Ocean Energy**:** Ocean Energy Potential against Wind and Solar, Wave Characteristics, and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.

Geothermal Energy: Geothermal Resources, Geothermal Technologies.

Hydro Energy**:** Hydropower resources, hydropower technologies, environmental impact of hydro power sources. *Piezoelectric Energy harvesting*: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power. *Electromagnetic Energy Harvesting*: Linear generators, physics mathematical models, recent applications,; Carbon captured technologies, cell, batteries, power consumption, Environmental issues and Renewable sources of energy, sustainability.

Demonstration Experiments: 1. Conversion of vibration to voltage using piezoelectric voltages. 2. Conversion of thermal energy into voltage using thermoelectric module.

Reference Books:

1. Non-conventional energy sources, B.H. Khan, McGraw Hill.
2. Solar energy, Suhas P Sukhative, Tata McGraw - Hill Publishing Company Ltd.
3. Renewable Energy, Power for a sustainable future, Godfrey Boyle, Oxford University Press.
4. Renewable Energy Sources and Emerging Technologies, Kothari et.al., PHI Learning.
5. Solar Energy: Resource Assessment Handbook, P Jayakumar.
6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
7. http://en.wikipedia.org/wiki/Renewable_energy

ELE OE 3.2: Fundamentals of Electronics.

Credits: 03 **Total Teaching: 45 hours**

Unit–1: **15 Hrs**

Passive Components: Overview of passive components-Fabrication, Types, colour coding, and applications.
Transformer: Principle, construction and working, turn ratio, Types of transformers (Step up and Step down).
Semiconductors: Intrinsic and extrinsic semiconductors.
Diodes: P-N Junction theory, V-I Characteristics, Rectifiers, Clippers, and Clampers (Qualitative analysis only).
Special diodes: Zener diode, LED and LDR; Construction, working and applications.

Unit -2: **15 Hrs**

Bipolar Junction Transistor (BJT): Physical structures, modes of operations, characteristics. Transistor as an amplifier, RC- Coupled amplifier, Darlington pairs, Transistor as a switch.
Field Effect Transistor (FET): Physical structures and modes of operations, Characteristics.
Electronic Instruments: Ammeter, Voltmeter- design and construction, analog millimeter, Digital millimeter, function generator (Qualitative analysis only). Cathode Ray Tube (CRT), Cathode Ray Oscilloscope (CRO)- Block diagram.
Digital fundamentals: Binary numbers, signed binary numbers, binary to decimal and Decimal to Binary conversion, Binary additions, and Subtractions,
Logic gates: AND, OR and NOT gates.

Unit -3: **15 Hrs**

Component and Device Applications: To design and Construct at least Ten of the following circuits.

1. V –I characteristics of semiconductor diode.
2. V –I characteristics of Zener diode. Determination of breakdown voltage.
3. V –I characteristics of LED. Determination of Cut-in voltage.
4. Characteristics of LDR.
5. Half wave rectifier; with and without filter. Determination of ripple factor.
6. Full wave rectifier (Centre tap/ Bridge); With and without filter, determination of ripple factor.
7. Zener diode voltage regulator; determination of line and load regulation.
8. Clipping circuits; Positive clipper, Negative Clipper, Biased positive and negative clippers. Trace the input and output waveforms.
9. Clamper circuits: Positive clamper, Negative Clamper. Trace the input and output waveforms.
10. Input and output characteristics of a transistor in Common Emitter configuration, determine of current gain β.
11. Input and output characteristics of a transistor in common base configuration, determine the current gain α.
12. Transistor as a switch.
13. Construct RC coupled amplifier. Plot the frequency response curve and determine the bandwidth.
14. V-I Characteristics of Common Source (CS) configuration of FET. Determine the current

gain.

15. Construct an ammeter to read (0-1ma) of current.
16. Construct a voltmeter to read (0-1volt).
17. Measure Vp, Vpp and Time period of Sine and Square waves using CRO.
18. Construct OR, AND and NOT gates using diodes and transistors. Verify the truth tables.
19. Verify the truth tables OR, AND and NOT gates using Integrated Chips (ICs).
20. Construct four-bit binary adder.

References

1 "A Textbook of Electronics" R. S. Sedha; S Chand and Co, 3rd edition.
2 "Principles of Electronics", V K Mehta and Rohit Mehta, S Chand and Co
3 "Basic Electronics", B L Theraja, S Chand and Co, 3rd edition 2012
4 "Electronic Devices", Devid Bell, Reston Publishing Company.
5 "Electronic Devices and Circuit Theory", Pearson edition.
6 "Digital Principles and Applications", Malvino and Leach
7 "Electronics text lab manual", Paul B Zabar

ELE OE 3.3: Application of Electronics-1

Credits: 03 **Total Teaching : 45 hours**

Unit–1: Basic Electronics **12 Hrs**

Introduction to circuit components- Resistors, capacitors, inductor, transformer, diode and transistor. Symbols, pimples.
LED and LCD display, relay, fuse, switches, wires. AC and DC applications.

Unit -2: Applied Electronics **13 Hrs**

Electronic instruments: DMM, CRO, Biomedical instruments-ECG, EEG, EMG, pH meter, X-ray, sphygmomanometer, Glucometer, Digital thermometer. Sensor-OMR, MICR, Scanner, Barcode reader.

Unit -3: Power Supplies **10 Hrs**

Dc power supply, Rectifiers-principle, Types
Inverter and UPS. Adopter and SMPS. Inverter and UPS. Mobile chargers.

Unit -4: Electronic calculators **10 Hrs**

Types, Functions of Basic calculators-block diagram, Keypad using, use of calculator.

References

1 Basic Electronics-Solid State – B L Theraja - S Chand And Company Ltd
2 Electronic Devices And Circuit Theory – Robert L Boylestad And Louis Nashelsky (PHI)

ELE-OE 3.4: Basics of Power Electronics, and e-Vehicles

Credits: 03 **Total Teaching: 45 hours**

Unit-1 **25 Hours**

Generation of and distribution of electricity*:* Mention of hydro electric generator, diesel generator, thermal generator, wind power, solar, ocean waves. Generation of DC power – Mention of batteries. Single phase, Two phase and Three phase. Transformers. Power transmission and distribution. Domestic electrical wiring – connection from AC line to the meter, sockets, mention of phase neutral and the need of earthing. Mention of electric shock and safety. Mention of power type (ac or dc) and current ratings for home appliances. Mention of tester. Electric motor working principle. Inverter, Uninterrupted Power supply (UPS) – online and off line UPS, SMPS.

Demonstration Experiments: 1. Un boxing and assembling of desktop computers. 2. Types of motors and transformers used in household appliances. 3. Understanding voltage, current, frequency etc. of ac mains. 4. Up gradation of RAM, hard disk and SSD. 5. SMPS: Block diagram and working Inverter

Unit – 2 **20 Hours**

Electric and Hybrid Electric Vehicles Configuration of Electric Vehicles, Performance of Electric Energy storage for EV and HEV Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, Super Capacitors. Power Electronic Converter for Battery Charging, Charging methods for battery, Termination methods, charging from grid.

Demonstration Experiments: Demonstration Experiments: 1. Types of motors and transformers used in household appliances. 2. SMPS: Block diagram and working Inverter. 3.Simulation and analysis of electrical systems using matlab.

Reference books:

1. Electrical Circuits, K.A. Smith and R.E. Alley, Cambridge University Press.
2. A text book in Electrical Technology - B L Theraja - S Chand & Co.
3. A text book of Electrical Technology - A K Theraja.
4. Performance and design of AC machines - M G Say ELBSEdtion.
5. Basic electrical engineering - V K Mehta and Rohit Mehta, S Chand and Company.
6. M. Ehsani, Y. Gao, S. Gay and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, CRC Press, 2005
7. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003
8. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
9. C.C. Chan and K.T. Chau, Modern Electric Vehicle Technology, OXFORD University Press, 2001
10. Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Wiley Publication, 2011.

ELE OE 3.5: Microprocessors

Credits: 03 **Total Teaching : 45 hours**

UNIT 1 **15 hrs**

Introduction to Microprocessor

Introduction, applications, basic block diagram, speed, word size, memory capacity, classification of microprocessors (mention different microprocessors being used)

Microprocessor 8085: Features, architecture -block diagram, internal registers, register pairs, flags, stack pointer, program counter, types of buses. Multiplexed address and data bus, generation of control signals, pin description of microprocessor 8085.

8085 Instructions-Operation code, Operand & Mnemonics.

Instruction set of 8085, instruction classification, addressing modes, instruction format.

Data transfer instructions, arithmetic instructions, increment & decrement instructions, logical instructions, branch instructions and machine control instructions.

UNIT 2 **15 hrs**

Stack operations and Microprocessor Programming

Stack operations, subroutine calls and return operations. Delay loops, use of counters, timing diagrams-instruction cycle, machine cycle, T- states, time delay-numerical examples.

Programs for data transfer and memory operations (direct & indirect addressing), addition and subtraction of two 8-bit & 16- bit numbers, multiplication, display of smallest / largest number in a given array of numbers, sorting of numbers in descending / ascending order. Number of 1's and 0's in a given byte, testing for zero condition. 1's and 2's complements. Verification of truth tables of logic gates, program to add two N byte numbers, program to generate Fibonacci series up to the limit, program to find the factorial of a number, program to find the GCD of two integer numbers.

UNIT 3 **15 hrs**

I/O instructions and Interfacing

I/O instructions and, interrupts in 8085. Basic interfacing concepts, compatible ICs of μP 8085, data transfer, synchronous I/O data transfer using interrupts.

Memory interfacing – address decoding, interfacing RAM and ROM.

Interfacings I/O devices– input port, output port, IN & OUT instructions, interfacing input devices (interfacing matrix key board-block diagram), interfacing output devices (LED display interfacing-block diagram).

PPI IC 8255– features, pin diagram, functional block diagram, ports & their modes.

Text Books

1. Microprocessor Architecture, Programming and Applications with 8085 Ramesh S.Gaonkar - Wiley Eastern Limited- IV Edition.
2. Fundamentals of Microprocessor & Microcomputer: B. Ram—Danpat Rai Publications.

Reference Books

1. Microprocessor and Interfacing- Programming & Hardware, Douglas hall, 2e TMH, 1991
2. Modern Digital Electronics, R.P. Jain–Tata Mc- GRAW hill–2nd Edition.
3. Microprocessor and its Applications- R.Theagarajan, S. Dhanasekaran and S. Dhanapal-New Age International Publishers.
4. Microprocessors and Microcontrollers-B.P singh, Galgotia publications.
5. The intel Microprocessors 8086/8088,80186,386,486, architecture, Programming and interfacing – Barry. B. Bray, PHI, New Delhi.
6. Microprocessor Lab Manual- G.T Swamy- Lakshmi Publications 2006.

ELE OE 3.6: Robotics.

Credits: 03 **Total Teaching : 45 hours**

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 time delay() function, delay Microseconds() function ,millis() function , micros() function

Unit -3: 15 Hrs

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

References

1 Fundamentals of Robotics by D K Pratihar
2 Robotics Simplified: An Illustrative Guide to Learn Fundamentals of Robotics,by Dr. Jisu Elsa Jacob , Manjunath N
3 Introduction to Robotics | Fourth Edition by John Craig
4 Arduino Robotics by John-David Warren (Author), Josh Adamsduino
5 Programming in 24 Hours by Richard Blum
6 Getting Started with Arduino: The Open Source Electronics Prototyping Platform Book by Massimo Banzi and Michael Shiloh

ELE OE 3.7: Medical Electronics.

Credits: 03 **Total Teaching : 45 hours**

Unit–1: 10Hrs

Fundamental Electronics: Amplifiers, Frequency response, signal generation. Different types of transducers & their selection for biomedical applications. Electrode theory, selection criteria of electrodes & different types of electrodes Bio electric amplifiers

Unit -2: 12 Hrs

Introduction to Bio-medical instruments: Origin of bio-electric signals, active & passive transducer for medical application –Electrocardiography-waveform-standard lead systems, typical ECG amplifier, EEG electrode, recording systems, EMG basic principle-block diagram of a recorder.

Unit -3: 10 Hrs

Medical Imaging: Nature and production od X-rays, Improving X-ray images, Computerised axial tomography, Using ultrasound in medicine, Ultrasound scanning, Magnetic resonance imaging PET and SPECT Imaging

Unit -4: 13Hrs

Biomedical Signal Processing: Fundamentals of signal processing, digital image, transforming image, image enhancement, image Segmentation, image compression, image restoration and reconstruction of medical images.
Demonstration using MATLAB

References

1 L Cromwell, F J Weibell, Eapfeiffer, Biomedical Instrumentation and measurements, PHI Publications.

Fourth Semester Syllabus

4th Semester BSc Electronics
ELE CT 4: Electronic Communication-I

Credits : Theory - 04 Practicals – 02 **Total Teaching : 56 hours**

Course Objectives:

- To understand the communication system, Principle and working communication system, means andmedium 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 fiber 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 andable to construct simple pulse modulation.
CO5. Understand the basic concept of Satellite Communication
CO6. Understand the basic concept of Optical Fibre Communication

UNIT 1 **14 hours**

Noise, T-lines and Antennas

Noise-Introduction, internal and external noises, signal to noise ratio and noise figure, numerical examples.
Transmission lines - types and equivalent circuit of T-lines, primary and secondary constants. reflection co-efficient, VSWR and CSWR-numerical examples, losses and distortions in T-lines. Wave propagation -ground wave, sky-wave and space wave propagations, ionosphere and its effects.
Antennas: Radiation mechanism, wire radiators in space-resonant antennas-radiation pattern and current distribution for different lengths, non - resonant antenna. Antenna parameters-gain, directive gain, power gain, bandwidth, beam width, polarisation, efficiency, radiation resistance, total effective resistance, Expression for the power radiated by antenna and radiation resistance. Ungrounded and grounded antenna. Qualitative study of –folded dipole, micro strip, dish, helical, horn, and loop antennas, numerical examples wherever applicable.

UNIT 2 **16 hours**

Block diagram of electronic communication system. Modulation, need and types of modulation (AM, FM & PM).
Amplitude modulation – representation, modulation index, Derivation for instantaneous voltage, frequency spectrum, power relations. Limitations of AM.

*Frequency M*odulation- definition, modulation index, frequency spectrum, bandwidth requirements, frequency deviation and carrier swing. Block diagram of AM and FM transmitter. Comparison of AM and FM, numerical examples wherever applicable.
Introduction to pulse communication: types- PAM, PWM, PPM, PCM – quantization, advantages and applications.
Satellite Communication - Introduction, need, geosynchronous satellite orbits, geostationary satellite advantages of geostationary satellites. Satellite visibility, transponders (C - Band), path loss, ground station, simplified block diagram of earth station. Uplink and downlink.

UNIT 3 **12 hours**

Radar communication systems

Introduction to Microwaves, frequency bands and applications.
RADAR Systems: RADAR– principles, maximum unambiguous range, detailed block diagram of pulsed RADAR system, RADAR range equation-derivation, factors influencing maximum range, Doppler effect, MTI RADAR-block diagram, CW RADAR-block diagram, advantages, applications and limitations, FM CW RADAR-block diagram, numerical examples wherever applicable.

UNIT 4 **14 hours**

Optical Fiber Communication

Introduction – need for OFC. Block diagram of OFC system. Fiber optic cables, light propagation through fiber – step index fiber, graded index fiber, Snell's law, numerical aperture (derivation). Types of optical fiber cables, light sources – requirements, LEDs and semiconductor laser diodes. Photo detectors – PN, PIN and avalanche photodiodes. Losses in optical fibers – Rayleigh scattering, absorption, leaky modes, bending, joint junction losses. Advantages and disadvantages of OFC over metallic cables, numerical examples wherever applicable.

Text Books:

1. Electronic Communication, George Kennedy, 3rd edition, TMH.
2. Electronic Communication, Roddy and Coolen, 4th edition, PHI.
3. Electronic Communication systems, Kennedy & Davis, IVth edition-TATA McGraw Hill.
4. Introduction to RADAR systems – Skolnik- McGraw Hill.
5. Advanced Electronic Communication systems, Wayne Tomasi- 6th edition, Low priced edition- Pearson education

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.

Semester IV - Practical IV

ELE-DSC4P: Electronic Communication-I Lab

1. Amplitude modulator and Demodulator
2. FM modulator using IC8038
3. Pre –emphasis and De- emphasis
4. Three way Audio cross over network.
5. IF amplifier
6. Automatic Gain Control
7. Frequency mixer
8. Frequency Multiplier
9. PWM and PPM
10. PAM modulator
11. Band Elimination Filter
12. Characteristics of OFC
13. VCO using IC 566
14. Time Division Multiplexing and de multiplexing
15. Study of Sensitivity, Selectivity and Fidelity of an AM radio receiver

Note:

1. **Minimum of 7 experiments to be performed. Simulation is to be carriedout for any two experiments.**
2. **One mini project is to be carried out for awarding practical IA marks**

ELE OE 4.1: Application of Electronics-2

Credits : 03 **Total Teaching : 45 hours**

Unit–1: Introduction to Advanced Communication 12 Hrs

Radio, TV- principles, block diagram & applications OFC applications and advantages,
Embedded system – Smart card, SIM card, Mobiles- Bock diagram &applications

Unit -2: Advance Electronics 12 Hrs

CCTV camera, ATM- principles, block diagram & applications
Electronic voting Machine (EVM)- CU,BU,VVPAT.,

Unit -3: Application of Satellite 11 Hrs

Types, EDUSAT, TV & Internet-modem, Wi-Fi.

Unit -4: E-waste management 10 Hrs

E-waste management-identification, segregation, disposal

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References

1 Basic Electronics-Solid State – B L Theraja - S Chand And Company Ltd

ELE-OE 4.2: Electronics For Everyone

Credits: 03 **Total Teaching: 45 hours**

Unit-1 **25 Hours**

Functional block diagram of 555 timer, Monostable operation and its Application, Astable operation and its Applications.

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-2 **20 Hours**

Demonstration of 555 timer and op-Amp by performing any seven of the following experiments either using simulation or circuit realisation

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

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. Instrumentation- Devices and Systems ByRangan, Sarma, and Mani, Tata-McGrawHill
5. Electronic Instrumentation by H.S Kalsi, McGraw Hill
6. Instrumentation measurements and analysis by Nakra&Choudhary
7. Measurement & Instrumentation- DVS Murthy
8. R. A. Gayakwad, Op-Amps and Linear IC's, Pearson Education (2003)
9. Electronic Sensor Circuits and Projects, III Volume, Forrest M Mims, Master Publishing Inc.
10. Timer, Op Amp, and Optoelectronic Circuits & Projects, Forrest M Mims, Master Publishing Inc.

ELE-OE 4.3: PCB DESIGN AND FABRICATION

Total Credits: 3 **Total teaching: 45 hours**

Unit I: **10 Hours**

Introduction to Printed circuit board: Fundamental of electronic components, basic electronic circuits, Basics of printed circuit board designing: Layout planning, general rules and parameters, ground conductor considerations, thermal issues, check and inspection of artwork.

Design rules for PCB: Design rules for Digital circuit PCBs, Analog circuit PCBs, high frequency and fast pulse applications, Power electronic applications, Microwave applications.

Unit II: **15 Hours**

Introduction to Electronic design automation(EDA) tools for PCB designing: Brief Introduction of various simulators, SPICE and PSPICE Environment, Selecting the Components Footprints as per design, Making New Footprints, Assigning Footprint to components, Net listing, PCB Layout Designing, Auto routing and manual routing. Assigning specific text (silkscreen) to design, Creating report of design, creating manufacturing data (GERBER) for design.

Unit III: **20 Hours**

Introduction printed circuit board production techniques: Photo printing, film- master production, reprographic camera, basic process for double sided PCBs photo resists, Screen printing process, plating, relative performance and quality control, Etching machines, Solders alloys, fluxes, soldering techniques, Mechanical operations. Demonstration **PCB design for EMI/EMC**: Subsystem/PCB Placement in an enclosure, Filtering circuit placement, decoupling and bypassing, Electronic discharge protection, Electronic waste; Printed circuit boards Recycling techniques, Introduction to Integrated Circuit Packaging and footprints, NEMA and IPC standards.

PCB Technology Trends: Multilayer PCBs. Multi wire PCB, Flexible PCBs, Surface mount PCBs, Reflow soldering, Introduction to High-Density Interconnection (HDI) Technology.

Text Books:

1. Printed circuit board design ,fabrication assembly and testing By R. S. Khandpur, Tata McGraw Hill 2006

Reference Books:

1. Printed circuit Board Design and technology, Walter C. Bosshart
2. Printed Circuits Handbook, Sixth Edition,by Clyde F. Coombs, Jr, Happy T. Holden, Publisher: McGraw-Hill Education Year: 2016
3. Complete PCB Design Using OrCAD Capture and PCB Editor, Kraig Mitzner Bob Doe Alexander Akulin Anton Suponin Dirk Müller, 2nd Edition 2009.
4. Introduction to System-on-Package, Rao R Tummala & Madhavan Swaminathan, McGraw Hill, 2008.
5. EMC and Printed circuit board **,**Design theory and layout**,** Mark I Montrose IEEE compatibility society.
6. Flexible Printed circuit board Design and manufacturing ,By Robert torzwell
7. Web-based Current literature.

ELE-OE 4.4: Mobile Communication

Credits: 03 **Total Teaching: 45 hours**

Unit 1 **09 Hours**

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 **09 Hours**

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 **09 Hours**

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 **09 Hours**

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

Unit 5 **09 Hours**

Wireless LAN-Infrared vs radio transmission- Bluetooth: user scenarios and architecture- LTE-3G, 4G, 5G-Wi-Fi - basic concepts.

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

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

ELE OE 4.5: Augmented and Virtual Reality

Credits :03 **Total Teaching : 45 hours**

Unit–1: Introduction to Virtual Reality 10Hrs

Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.

Unit -2: Augmented Reality 10 Hrs

AR: Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.

Unit -3: The Geometry of Virtual Worlds &The Physiology of Human Vision 12 Hrs

Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR. #Exemplar/ Case Studies Sweeping coverage of eye movements

Unit -4: Visual Perception & Rendering and Motion & Tracking 13 Hrs

Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates #Exemplar/ Case Studies Automatic stitching of panoramas in Virtual Reality. Motion in Real and Virtual Worlds- Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies.

References

1 E. Balagurusamy, - Computing Fundamentals and C Programming‖, Tata McGraw-Hill, 2008.
2 Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.
3 R.G.Dromey, How to Solve by Computer, Pearson Education, Inc, Reprint 2009.
4 Yashavant P. Kanetkar, ―Let Us C, Fifth Edition, Sridhara Publication, India, 2008.

ELE OE 4.6: Microcontrollers

Credits: 03 **Total Teaching : 45 hours**

UNIT 1 **10 hrs**

Introduction to Microcontrollers

Basic block diagram, comparison of microcontroller with microprocessors, comparison of 8 bit, 16 bit and 32 bit microcontrollers. Overview of 8051 series–comparison of 8051, 8052, 8031.

Microcontroller 8051- architecture -internal block diagram, key features of 8051, pin diagram, memory organization, Internal RAM memory, Internal ROM. General purpose data memory, special purpose/function registers, external memory.

Counters and timers – 8051 oscillator and clock, program counter, TCON, TMOD, timer counter interrupts, timer modes of operation. Input / output ports and circuits/ configurations, serial data input / output – SCON, PCON, serial data transmission modes.

UNIT 2 **20hrs**

8051- Interrupts, Addressing modes and Instruction set

Interrupts – IE, IP, time flag interrupts, serial port interrupt, external interrupts, reset, interrupt control, interrupt priority, interrupt destinations & software generated interrupts.

Addressing modes–immediate addressing, register addressing, direct and indirect addressing, Data transfer instructions – internal data move, external data move, code memory read-only data move, Push and Pop and data exchange instructions.

Logical Instructions – byte level logical operations, bit level logical operations, rotate and swap operations.

Arithmetic Instructions – flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic, simple programs in assembly language.

Jump and call instructions – jump and call program range, jumps, calls and subroutines, interrupts and returns, simple example programs in assembly language.

UNIT 3 **15 hrs**

Interfacing with 8051 and programming in C

Basic interfacing concepts and interrupts, Programming–8051 interrupts, programming Timer interrupts, programming the external hardware interrupts.

Schematic diagrams and basic concepts of Interfacing of 8051 to keyboard, seven segment display, stepper motor, DAC, ADC and traffic light controller circuits.

8051 programming using C– Data types and time delays in 8051C, I/O programming, logic operations, data conversion programs, accessing code ROM space and data serialization.

Timer / Counter Programming in 8051–Programming 8051 timers, counter, programming timers 0 and 1 in 8051 C, Example programs.

Books:

1. The 8051 Microcontroller and Embedded Systems Using Assembly and C, Second Edition, Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, Pearson edition.
2. The 8051 Microcontroller, Fourt Edition, Kenneth Ayala, Thomson publication.
3. 8051 Microcontroller, Architecture, Application and Programming, Mahalakshmi, ABE edition.
4. 8051 Microcontroller, Pearson edition, Subrotha Ghoshal.

5. 8051 Microcontroller based and Embedded Systems, Mc Graw Hill, Manish K Patil.

ELE OE 4.7: IOT and Applications

Credits: 03 **Total Teaching : 45 hours**

Unit–1: 12 Hrs

Fundamentals of IoT: Introduction, History of IoT, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, Components of an IoT Solution, IoT frameworks, IoT and M2M, Open Source and Commercial Examples, Competing Standards for IoT

Unit -2: 12 Hrs

Sensors Networks: Definition, Traditional Data Storage, Analog and Digital I/O Basics, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.

Unit -3: 11 Hrs

Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus. IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT. Edge connectivity and protocols

Unit -4: 10 Hrs

Data Handling& Analytics: Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage Applications of IoT: Home Automation

References

1 Internet of Things, Vasudevan, Nagrajanand and Sundaram, Wiley India.
2 Srinivasa K G “Internet of Things”, Cengage Learning, India 2017.
3 David Hanes, Gonzalo Salgueiro, Patrick Grosstete, Robert Barton, Jerome Henry, IoT fundamentals: Networking Technologies, Protocols and uses cases for the Internet of things, 1st Edition, Pearson Education.
4 Iot Fundamentals, David Hence et al, Cisco press.