Course Content: First Semester B Sc Electronics

Syllabus for Core Subjects **Appendix -2**

Course Title: Electronics	Course Credits: 4
Total Contact Hours: 56 Hrs	Duration of ESA: 4 Hrs
Formative Assessment Marks: 40 marks	Summative Assessment Marks :60 marks
Model Syllabus Authors:	BCU-BoS in Electronics

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. 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 understand the working principles of the electronic devices and their applications.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6
Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research	x					
To acquire experimental skills, analysing the results and interpret data.						
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.						
Capacity to identify and implementation of the formulate to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.						
Capability to understand the working principles of the electronic devices and their applications.	x					

ELE - CT1: ELECTRONIC DEVICES AND CIRCUITS **56 Hrs**

Content

UNIT – 1 **14 Hrs**

Electronic Components: Electronic passive and active components, types and their properties, Concept of Voltage and Current Sources, electric energy and power (Qualitative only).

Network Theorems: Review of KCL & KVL, Superposition, Thevenin's, Norton's, Maximum Power Transfer, and Reciprocity Theorems. DC and AC analysis of RC and RL circuits, RLC series and parallel Resonant Circuits.

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.

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 Hrs**

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.

Bipolar Junction Transistor: Construction, types, CE,CB and CC configurations (mention only), I-V 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 switch - circuit and working.

Numerical examples wherever applicable.

UNIT – 3 **14 Hrs**

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 for CE.

Amplifier: Small signal analysis of single stage CE amplifier using r_e- model. Input and Output impedances, Current and Voltage gains. Advantages of CC amplifier. Types of coupling, two stage RC Coupled Amplifier – circuit, working and its Frequency Response, loading effect, GBW product, Darlington transistor, Current gain.

Special semiconductor devices: LED, LCD and solar cell – construction, operation and applications, 7-segment display, conceptof common anode and common cathode types

Numerical problems, wherever applicable.

UNIT – 4 **14 Hrs**

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), Self

complementing property of Excess-3 and 2421 codes, Gray code, error checking and correction codes (Only parity check). ASCII and EBCDIC codes.

Boolean Algebra: Constants, variables, operators, Positive and negative logic, basic logic gates- AND, OR, NOT, Boolean laws, Duality Theorem, De Morgan's Theorems, simplification of Boolean expressions. Derived logic gates (NAND, NOR, XOR & XNOR). Universal property of NOR and NAND gates.

Numerical examples wherever applicable.

Suggested References

1. Robert L Boylestad, "Introductory circuit analysis", 5th edition., Universal Book 2003.
2. R S Sedha, "A Text book of Applied Electronics", 7th edition., S. Chand and Company Ltd. 2011.
3. A.P. Malvino, "Principles of Electronics", 7th edition, TMH, 2011.
4. Electronic devices and circuit theory by Boylestad, Robert Nashelsky, 11th edn., Pearson, 2013
5. David A. Bell "Electronic Devices and Circuits", 5th edition, Oxford University Press, 2015
6. Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia, (1994)
7. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Edn., TMH, 2011.
8. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, PHI Learning Pvt. Ltd. 2009
9. Digital Circuits and Systems, K R Venugopal and K Shyla, Tata McGraw Hill, 2011
10. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer,PHI Learning, 2001
11. M. Nahvi & J. Edminister, "Electrical Circuits", Schaum's Outline Series, TMH, 2005
12. S. A. Nasar," Electrical Circuits", Schaum's outline series, Tata McGraw Hill, 2004
13. J. Millman and C. C. Halkias, "Integrated Electronics", Tata McGraw Hill, 2001
14. A.S. Sedra, K.C. Smith, A.N. Chandorkar "Microelectronic circuits", 6th Edn., Oxford University Press, 2014
15. J. J. Cathey, "2000 Solved Problems in Electronics", Schaum's outline Series, TMG, 1991

Course Content: First Semester B Sc Electronics

Course Title: ELE-CP1: ELECTRONIC DEVICES AND CIRCUITS – Lab	Course Credits: 2
Total Contact Hours: 56 Hrs	Duration of ESA: 4 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.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**
Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research						
To acquire experimental skills, analysing the results and interpret data.	**x**					
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.						
Capacity to identify and implementation of the formulate to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.						
Capability to use the Modern Tools / Techniques.						

ELE-CP1: ELECTRONIC DEVICES AND CIRCUITS – Lab

(Hardware implementation and Analysis of Circuit using Simulation Software)

Content
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 Six)
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 different values of filter capacitors. 7. Study of full wave bridge rectifier without and with shunt capacitor filter – ripple factor for different 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 79xx series ICs (Using bridge rectifier and shunt capacitor filter). 11. Designing and testing of variable voltage regulator using IC LM317 (Using bridge rectifier and shunt capacitor filter).
Part – B (Any Six experiments including compulsory experiment No 14)
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 using respective 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 IC 7486.

Pedagogy: ICT lecture method, group discussion, seminar etc.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Active participation	05
Assignment	10
Attendance	10
Total	**25**

Course Content: First Semester B Sc Electronics

Course Title: ELE-OE 1.1: **DOMESTIC EQUIPMENT MAINTENANCE**	Course Credits: 3
Total Contact Hours: 45 Hrs	Duration of ESA: 3 Hrs
Formative Assessment Marks: 40 marks	Summative AssessmentMarks: 60 marks
Model Syllabus Authors:	BCU-BoS in Electronics

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 for the operation and maintenance of the domestic electrical/ electronic gadgets
6. Capability to use the Modern Tools / Techniques.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**
Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research	**x**					
To acquire experimental skills, analysing the results and interpret data.						
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.						
Capacity to identify and implementation of the formulate to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.						
Capability to use the Modern Tools / Techniques for the operation and maintenance of the domestic electrical/ electronic gadgets	**x**					

Pedagogy: ICT lecture method, group discussion, seminar etc.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Internal test	15
Assignment	15
Attendance	10
Total	**40**

ELE-OE 1.1: DOMESTIC EQUIPMENT MAINTENANCE **45 Hrs**

Content

UNIT – 1 **15 Hrs**

Geyser: Construction and working, parts and manufacturing process, types. Common faults and their troubleshooting: Dripping geyser overflow, overheating, steam or hot water escaping from overflow, water leaking through the ceiling, no hot water, water not hot enough, poor hot water pressure. Induction cooker: Construction and working, parts and manufacturing process, types. Common faults and their troubleshooting: Cooker fuse blown, cooker buttons not working, cook top shuts off while cooking, food not get cooked or heated properly, overheating and uneven heating, display keep flashing, weird noises–crackling, fan noise, humming sound, clicking.

UNIT – 2 **15 Hrs**

Microwave Oven: Working, raw material and manufacturing process, types,Common faults and their troubleshooting: Microwave does not heat, runs then stops, buttons do not work, plate do not spin, bulb does not turn ON during operation, sparking inside, shuts OFF after few seconds.

Refrigerator: Working, raw material and manufacturing process, electrical wiring diagram, types of refrigerator. Common faults and their troubleshooting: fridge not cooling, fridge not defrosting, leaking water, freezing food light not working, freezer is cooled but fridge stays warm, dead refrigerator, not enough cooling, keeps running, leakage, makes noise. Replacement procedure for: seal (gasket), evaporator fan motor, PTC relay, thermostat, compressor, bulb.

Demonstration Experiments: 1. Working of Geyser. 2. Working of Microwave Oven. 3. Working of Induction Cooker.

UNIT – 3 **15 Hrs**

Air Conditioner: Working, raw material and manufacturing process, electrical wiring diagram, types. Common Faults and their troubleshooting: Faults in following parts of AC: Filter, thermostat, refrigerant leaks, breakers, capacitors, compressor, evaporator coils, condenser coils, warm contactor. General faults: AC UNIT has an odour, shuts ON and OFF repeatedly, does not blow cold air, repeatedly tripping a circuit breaker, indoor UNIT is leaking water inside the room, outdoor UNIT is making an unusually loud sound, room is not getting cold enough, AC not turning ON.

Demonstration Experiments: 1. Working of Air Conditioner. 2. Working of Refrigerator.

Suggested References

1. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting, R. G. Gupta TMH, 2001.
2. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance, R S Khandpur, TMH, 1987.
3. Electronic fault diagnosis by G. C. Loveday, A. H.., Longman, 4th Edition, 1994.

Course Title: ELE-OE 1.2: **RENEWABLE ENERGY AND ENERGY HARVESTING**	Course Credits: 3
Total Contact Hours: 45 Hrs	Duration of ESA: 3 Hrs
Formative Assessment Marks: 40 marks	Summative Assessment Marks: 60 marks
Model Syllabus Authors:	BCU-BoS in Electronics

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 of the energy demands

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**
Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research	**x**					
To acquire experimental skills, analysing the results and interpret data.						
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.						
Capacity to identify and implementation of the formulate to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.						
Capability to use the Modern Tools / Techniques of the energy demands	**x**					

Pedagogy : ICT lecture method, group discussion, seminar etc.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Internal test	15
Assignment	15
Attendance	10
Total	**40**

ELE-OE 1.2: RENEWABLE ENERGY AND ENERGY HARVESTING **45 Hrs**

Content

UNIT – 1 **15 Hrs**

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.

UNIT – 2 **15 Hrs**

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

UNIT – 3 **15 Hrs**

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.

Suggested References

1. Non-conventional energy sources, B.H. Khan, McGraw Hill., 3rd Edition, 2017
2. Solar energy- Principles of Thermal collection and Storage. Suhas P Sukhatme, 15th Edition, TMH., 2006
3. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press. 3rd edition, 2012
4. Renewable Energy Sources and Emerging Technologies, Kothari D P, Singhal K C, Ranjan Rakesh, 2nd Edition, PHI Learning, New Delhi, 2011
5. Solar Energy: Resource Assessment Handbook, P. Jayakumar, e-book., 2009.

Course Content: First Semester B Sc Electronics

Course Title: ELE-OE 1.3: **BASICS OF POWER ELECTRONICS AND E-VEHICLES**	Course Credits: 3
Total Contact Hours: 45 Hrs	Duration of ESA: 3 Hrs
Formative Assessment Marks: 40 marks	Summative Assessment Marks: 60 marks
Model Syllabus Authors:	BCU-BoS in Electronics

Course Outcomes (COs):

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

1. Acquire the knowledge of generation and electricity distribution systems
2. Understand working of Electric Vehicles and recent trends
3. Analyse different power converter topology used for electric vehicle application
4. Develop the electric propulsion UNIT and its control for application of electric vehicles

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**		**6**
Acquire the knowledge of generation and electricity distribution systems	**x**					
Understand working of Electric Vehicles and recent trends	**x**					
Analyse different power converter topology used for electric vehicle application	**x**					
Develop the electric propulsion UNIT and its control for application of electric vehicles	**x**					

Pedagogy: ICT lecture method, group discussion, seminar etc.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Internal test	15
Assignment	15
Attendance	10
Total	**40**

Course Content: First Semester B Sc Electronics

ELE-OE 1.3: BASICS OF POWER ELECTRONICS AND E-VEHICLES 45 Hrs

Content

UNIT – 1 **20 Hrs**

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: SMPS: Block diagram and working of Inverter

UNIT – 2 **25 Hrs**

E-Vehicles: Electric and Hybrid Electric Vehicles Configuration of Electric Vehicles, Performance of Electric Energy storage for EV and HEV Energy storagerequirements, 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: 1. Types of motors and transformers used in household appliances. 2. SMPS: Block diagram and working Inverter.

Simulation and analysis of electrical systems using MATLAB.

Suggested References

1. Electrical Circuits, K.A. Smith and R.E. Alley, Cambridge University Press, 2012.
2. A Text Book in Electrical Technology - B L Theraja - S Chand & Co., 2005
3. Performance and design of AC machines - M G Say, CBS Publishers and Distributers Pvt Ltd., 3rdEdition, 2002, e-book edition 2017.
4. Basic Electrical Engineering - V K Mehta and Rohit Mehta, 6th Edition, S Chand and Company,2006
5. M. Ehsani, Y. Gao, S. Gay and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles:Fundamentals, Theory, and Design, 1st edition, CRC Press, 2004
6. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, 3rd Edition, CRC Press, 2021
7. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid ElectricVehicles, Springer, 2013.
8. C.C. Chan and K.T. Chau, Modern Electric Vehicle Technology, OXFORD University Press, 2001
9. Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles Principles and Applications with Practical Perspectives, Wiley Publication, 2011.

Course Content: First Semester B Sc Electronics

Course Title: ELE-OE 1.4 **PCB DESIGN AND FABRICATION**	Course Credits: 3
Total Contact Hours: 45 Hrs	Duration of ESA: 3 Hrs
Formative Assessment Marks: 40 marks	Summative Assessment Marks: 60 marks
Model Syllabus Authors:	BCU-BoS in Electronics

Course Outcomes (COs):

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

1. Understand basics of PCB designing.
2. Apply advanced techniques, skills and modern tools for designing and fabrication of PCBs.
3. Apply the knowledge and techniques to fabricate Multilayer, SMT and HDI PCB.
4. Understand concepts of Packaging.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6
Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research	x					
To acquire experimental skills, analysing the results and interpret data.						
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.						
Capacity to identify and implementation of the formulate to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.	x					
Understand the theory and experimental skills in the design and fabrication of the PCB	x					

Pedagogy: ICT lecture method, group discussion, seminar etc.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Internal test	15
Assignment	15
Attendance	10
Total	**40**

ELE-OE 1.4 - PCB DESIGN AND FABRICATION **45 Hrs**

Content

UNIT – 1 **15 Hrs**

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 – 2 **15 Hrs**

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.

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.

UNIT -3 **15 Hrs**

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.

Demonstration : Demonstration on the PCB designing and etching experiments.

Suggested References

1. Printed Circuit Board Design, Fabrication Assembly and Resting. R. S. Khandpur, TMH, 2006
2. Printed circuit Board Design and technology, Walter C. Bosshart, TMH, 1983
3. Printed Circuits Handbook. Clyde F. Coombs, Jr, Happy T. Holden, 6th Edn., TMH Education, 2016.
4. Complete PCB Design Using OrCAD Capture and PCB. Kraig Mitzner Bob Doe Alexander AkulinAnton Suponin Dirk Müller, 2nd Edition., 2019.
5. Introduction to System-on-Package – miniaturization of entire system, Rao R Tummala & Madhavan Swaminathan, TMH, 2008.
6. EMC and Printed Circuit Board Design - Theory and Layout, Mark I Montrose., IEEE Press., 2010

ELE-OE 1.5: Digital Fundamentals

Course Title: ELE-OE 1.5: Digital Fundamentals	Course Credits: 3
Total Contact Hours: 45 Hrs	Duration of ESA: 3 Hrs
Formative Assessment Marks: 40 marks	Summative Assessment Marks: 60 marks
Model Syllabus Authors:	BCU-BoS in Electronics

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 develop mobile app

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6
Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research	X					
To acquire experimental skills, analysing the results and interpret data.						
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.						
Capacity to identify and implementation of the formulate to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.						
Capability to develop mobile app.	X					

ELE-OE 1.5: Digital Fundamentals **45 Hrs**

Unit 1 **20Hrs**

Number Systems: Introduction to number systems – positional and non-positional, Base /Radix. Decimal number system-Definition, digits, radix/base, Binary number system – Bit Byte, Conversions: Binary to Decimal and Decimal to Binary. Octal number systemConversion from Octal to Decimal to Octal, Octal to Binary and binary to Octal. Hexadecimal number system –Conversion : Decimal to Hex, Hex to decimal, Hex to Binary, Binary to Hex, Octal to Hex, Hex to Octal, Binary, arithmetic – addition, subtraction, multiplication and division (only Integer part- for binary and Hexdecimal). 1's and 2's compliment: 2's complement subtraction. Binary code: BCD numbers, 8421 code, 2421 code- examples and applications. Gray code –Conversions-Gray to binary and Binary to Gray, application of gray code (Mention only). Excess-3 code – self complimenting property and applications. Definition and nature of ASCII code. Introduction to error detection and correction code, parity check.

Unit 2 **25 Hrs**

Boolean algebra: Laws and theorems. AND, OR, NOT Laws, Commutative law, associative law, distributive law, Duality theorem. Demorgan's theorems-Statements, proof using truth tables; Simplification of Boolean expressions using Boolean laws. Logic Gates: AND Gate: Definition, symbol truth table, timing diagram, Pin diagram of IC 7408. OR Gate: Definition, symbol, truth table, timing diagram of IC 7432. NOT Gate: Definition symbol, truth table, timing diagram, Pin diagram of IC 7404. NAND Gate: Definition, symbol, truth table, Pin diagram of IC 7400, NOR Gate: Definition, symbol, truth table, timing diagram, Pin diagram of IC 7402. Exclusive OR Gate: Definition, symbol, truth table, timing diagram. Definition of product term, sum term, minterm, maxterm, SOP, standard POS and Standard POS. Conversion of Boolean expression to Standard SOP and Standard POS forms. Karnaugh maps-Definition of Karnaugh map, K- map for 2, 3 and 4 variables. Conversion of truth tables into k-map grouping of cells, redundant groups and don't care conditions Karnaugh map technique to solve 3 variable and 4 variable expressions. Simplification of 3 and 4 variable Boolean expression using K-maps (SOP only).

Text Books:

1) Thomas L.Floyd ,''Digital Fundamentals", Peason Education Inc, New Delhi, 2003

Reference Books:

1) Morris Mano, "Digital Design", 5 Th Edition, Prentice Hall, 2013
2) R.P.Jain, "Modern Digital Electronics", 3rd Edition, Tata Mc Graw Hill, 2003.
3) Bignell and Donovan, "Digital Electronics", 5th Edition, Thomson Publication, 2007.

Pedagogy : ICT lecture method, group discussion, seminar etc.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Internal test	15
Assignment	15
Attendance	10
Total	**40**