BENGALURU CITY UNIVERSITY

Curriculum for B.Sc. Basic / Honours (ELECTRONICS)

(*According to NEP – 2020 Regulations*)

Subject: ELECTRONICS

(2021 – 22 *Onwards)*

Bengaluru City University
Bengaluru – 560009

September/ October- 2021

CONTENTS

PROCEEDINGS OF BoS MEETING

Meetings of BoS UG was convened at Department of Electronic Science, Jnanabharathi Campus, Bangalore University, Bangalore – 560056 to frame the syllabus for B.Sc. Electronics course under the National Education Policy (NEP)-2020. The committee convened twice *i.e.,* on 30.09.2021 and 01.10.2021. Referring to the syllabus drafted by State expert committee for the model curriculum contents in Electronics, exhaustive deliberations were made. Finally, with minor modifications the Syllabus was submitted to the Registrar, Bengaluru City University, Bengaluru.

The following members were present.

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	-Sd-
2.	Sri. K M Thipperudra Swamy Associate Professor, Department of Electronics, Vivekananda Degree College, Bengaluru – 560055	Member	-Sd-
3.	Sri. S M Mruthunjaya Swamy Associate Professor, Department of Electronics, Vijaya College, R V Road, Bengaluru – 560004	Member	-Sd-
4.	Sri. S Sanjeev Associate Professor, Department of Electronics, Vijaya College, Jayanagar, Bengaluru – 560011	Member	-Sd-
5.	Dr. H J Thontadharya Associate Professor, Department of Electronics, Vijaya College, R V Road, Bengaluru – 560004	Member	-Sd-
6.	Sri. K G Lakshminarayana Associate Professor, Department of Electronics, Vijaya College, Jayanagar, Bengaluru – 560011	Member	-Sd-
7.	Smt. Rajashri Padaki Associate Professor, Department of Electronics, Seshadripuram First Grade College, Yelahanka New town, Bengalure-560064	Member	-Sd-
8.	Dr. Mohana H K Assistant Professor, Department of Electronics, Seshadripuram First Grade College, Yelahanka New town, Bengaluru -560064	Member	-Sd-
9.	Dr Ravi Kolarkar G Associate Professor, Department of Electronics, Nrupathunga University,Bengaluru -560001	Member	-Sd-
10	Dr. Bharathi Assistant Professor, Department of Electronics, Maharani Cluster University, Bengaluru -560001	Member	-Sd-
11	Sri. Vijaya Kumar A Patil Associate Professor, Department of Electronics, Basaveshwara College of Commerce, Arts and Science, Bengaluru -560010	Co-opted Member	-Sd-

The Chairman extended warm welcome to the newly constituted BoS and thanked them for accepting the assignment.

The main agenda of the meeting i.e., framing of syllabus for the B.Sc. Degree in Electronics under NEP , was taken for discussion. After thorough discussions the following resolutions were made.

Resolutions:

1. The committee unanimously agreed to adopt the structure (*appendix – 1*) suggested by the Karnataka State Higher Education Council (KSHEC) under NEP programme and also to consider the proposed curriculum for the First and Second semesters UG program in Electronics (a*ppendix -2*) with effect from academic year 2021- 22.

2. Minor changes in the curriculum were made related to the teaching hours for theory & practical classes, maximum marks for the papers and minimum marks for passing, credits to the respective papers, etc.

3. Students who have passed PUC/ 10+2 /ITI / Diploma (Electronics / Electrical / Medical Electronics / Computer Science / Telecommunications) or equivalent are eligible for opting Electronics in UG program.

4. The board discussed about the option for the candidates to choose the open elective paper. After elaborate discussions it was unanimously decided that open elective may be given to any student including the candidate opted electronics as major/minor core subjects.

5. The Scheme for awarding internal assessment marks for the students was discussed and approved.

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

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

Chairman

Preamble

This model curriculum content for B.Sc. (Basic/Honours) Electronics as per NEP-2020 is intended to enable the graduates to respond to the current needs of the industry and equip them with skills relevant for national and global standards. The framework encourages innovation in teaching-learning process and appropriate assessment of student learning levels.

Introduction

B.Sc. (Basic/Honours) Electronics is a program which needs to develop a specialized skill set among the stake holders to cater to the need of industries. The curriculum is designed to help students to analyse, appreciate, understand and critically engage with learning of the subject and also to provide better learning experience to the stake holders. Apart from imparting disciplinary knowledge, the curriculum is aimed to equip the students with competencies like problem solving and analytical reasoning which provide them high professional competence. The University is expected to encourage its faculty concerned to make suitable pedagogical innovations, in addition to teaching learning processes suggested in the model curriculum, so that the Course/Programme learning outcomes can be achieved.

Significance of Electronics

Nowadays, Electronics has made unprecedented growth in terms of new technologies, new ideas and principles. The research organizations and industries that work in this frontier area are in need of highly knowledgeable, skilled and scientifically oriented manpower. This manpower can be available only with flexible, adaptive and progressive training programs and a cohesive interaction among the institutions, universities and industries. The key areas of study within Electronics subject comprise: Semiconductor devices and its application, Analog and digital circuit design, Microprocessors & Microcontroller systems, Computer coding/Programming

in high level languages etc. and also modern applied fields such as Embedded systems, Data communication, Robotics, Control systems, IoTs, etc,.

Eligibility criteria

Students who have passed PUC/ 10+2 / ITI / Diploma (Electronics / Electrical / Information Science / Medical Electronics/ Computer Science/ Telecommunications) or equivalent are eligible for opting Electronics in UG program.

Program Objectives

The overall Objectives of the B.Sc. (Basic / Honours) Electronics program are to:

- Provide students with learning experiences that develop broad knowledge and understanding of key concepts of electronics and equip students with advanced scientific / technological capabilities for analyzing and tackling the issues and problems in the field of Electronics.
- Develop ability in students to apply knowledge and skills acquired to solve specific problems in Electronics.
- Develop abilities in students to design and develop innovative solutions for the benefit of society.
- Provide students with skills that enable them to get employment in various organisations, industries, pursue higher studies, research assignments and turn as entrepreneurs.

Program outcomes

- Ability to apply knowledge of logical thinking and basic science for solving Electronics related problems.
- Ability to perform Electronics experiments, as well as to analyse and interpret data.

- Ability to design and manage Electronic systems or processes that conforms to a given specification within ethical and economic constraints.
- Ability to identify, formulate, analyse and solve the problems in various sub disciplines of Electronics.
- Ability to use Modern Tools / Techniques.

Tentative Program Structure
(Major Discipline: ELECTRONICS) - Semesters 1 – 10

SEMESTER	Discipline Core (DSC)	Title of the Paper	Open Elective (OE)
1	DSC 1	Electronic Devices and Circuits	OE 1.1: Domestic Equipment Maintenance OE 1.2: Renewable Energy and Energy Harvesting OE 1.3: Basics of Power Electronics and E-Vehicles OE 1.4: PCB Design and Fabrication OE 1.5: Digital Fundamentals
2	DSC 2	Analog and Digital Electronics	OE 2.1: Consumer Electronics OE 2.2: Industrial Electronics OE 2.3: C Programming and interfacing with Arduino OE 2.4: Mobile communication OE 2.5: Mobile Application Programming OE 2.6: Digital Sysytems
3	DSC 3	Digital Design Using Verilog and Programming in C	OE 3.1: Robotics OE 3.2: Introduction to Nano Science & Nano ElectronicsOE 3.3: Medical Electronics OE 3.4: Solar Energy, Devices and Applications OE 3.5: IC Fabrication Techniques
4	DSC 4	Electronic Communications – I	OE 4.1:App Developments OE 4.2: MEMS and Sensors OE 4.3: IoT and Applications OE 4.4: Virtual Reality & Real Time Applications
			Discipline Specific Elective (DSE)
5	DSC 5 DSC 6	Microcontroller 8051 and PIC Electronic Communications - II	DSE 1: Computer Organization DSE 2: RFID Technology DSE 3: Photonics
6	DSC 7 DSC 8	Power Electronics, PLCs, Sensors, Transducers, andInstrumentation IOT and 5G communications	DSE 4: Cryptography DSE 5: Control Systems DSE 6: Project work (0+1+2)
7	DSC 9 DSC 10 DSC 11	Signals and Systems Embedded Systems Microwave Communications	DSE 7: Wireless communication DSE 8: Python Programming DSE 9: Mechatronics
8	DSC 12 DSC 13 DSC14	Digital Signal Processing VLSI Designing Image Processing	DSE 10: ARM Processor DSE 11: Computer Network DSE 12: AI, ML and Python Research Project

YEAR	OBJECTIVES	NATURE OF COURSES	OUTCOME	NO. OF COURSES
1st year – (1st & 2nd Semesters)	Understanding the basic concepts	1. Major Core Courses 2. Minor/Related Discipline 3. Languages 4. Ability Enhancement Compulsory Courses 5. Skill Enhancement/Development Courses	 Understanding of Disciplines Language Competency Gaining perspective of context/Generic skills Basic skills sets to pursue any certificate level jobs	1+1 1+1 2+2 1+1 1+1
EXIT OPTION WITH CERTIFICATE				
2nd Year (3rd & 4th Semesters)	Focus and Immersion	1. Major Core Courses 2. Minor/ Related Discipline 3. Ability Enhancement 4. Skill based Vocational 5. Extra-curricular Activities	Understanding of disciplines Gaining perspective of context Skill sets to pursue vocation Development of various Domains of mind & Personality	2+2 1+1 1+1 1+1 1+1
EXIT OPTION WITH DIPLOMA				
3rd Year - (5th & 6th Semesters)	Real time Learning	1. Major Discipline Core and Elective Courses 2. Minor Discipline / Generic or Vocational Electives / Field based Learning/ Research Project	In depth learning of major and minor disciplines, Skill sets for employability. Exposure to discipline beyond the chosen Subject Experiential learning/Research.	2+2 1+1 1+1
EXIT OPTION WITH BACHELOR DEGREE				
4thYear - (7th & 8th Semesters)	Deeper Concentration	Major Discipline Core and Elective Courses Research / Project Work with Dissertation	Deeper and Advanced Learning of Major Discipline Foundation to pursue Doctoral Studies & Developing Research competencies	4+4 4+4
EXIT OPTION WITH HONOURS DEGREE				
5th Year - (9th & 10th Semesters)	Master of the subject	Major Discipline Core and Elective courses/ Research/ Project Work with Dissertation	Deeper and Advanced Learning of the Major Discipline towards gaining proficiency over the subject	4+4 /6+6
MASTERS DEGREE				

APPENDIX-1

PROGRAM PATTERN AND SCHEME OF EXAMINATION FOR B.SC. (Basic /Honours) IN 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	I	**ELE-CT1:** *Electronic Devices and Circuits*	**56**	**4**	**4**	**60**	**21**	**40**	**25**	**09**	**25**	**3**	**4**	**150**	**4**	**2**
		ELE-OE 1.1 / 1.2 / 1.3 / 1.4 / 1.5	**45**	**3**	**-**	**60**	**21**	**40**	**-**	**-**	**-**	**3**	**-**	**100**	**3**	**-**
2	II	**ELE-CT2:** *Analog and Digital Electronics*	**56**	**4**	**4**	**60**	**21**	**40**	**25**	**09**	**25**	**3**	**4**	**150**	**4**	**2**
		ELE-OE 2.1 / 2.2 / 2.3 / 2.4 / 2.5 / 2.6	**45**	**3**	**-**	**60**	**21**	**40**	**-**	**-**	**-**	**3**	**-**	**100**	**3**	**-**

Scheme of Internal Assessment Marks: **THEORY**

Sl. No.	Particulars	IA Marks
1	Attendance / Specified Activity in the syllabus	**05***
2	Internal Tests (Minimum of Two)	**15**
3	Assignments /Seminar / Case Study / Project work / Reports on - visits to industries/exhibitions/science centre's / active participation in Electronics competitions, etc.	**20**
	TOTAL Theory IA Marks	**40**

**** Criteria for awarding the marks: 75-85% - 2 marks; 85-95% - 4 marks and > 95% - 5 marks***

Scheme of Internal Assessment Marks: **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**

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**					

Course Content: First Semester B Sc Electronics

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.						

Course Content: First Semester B Sc Electronics

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**

SECOND SEMESTER

Course Content: First Semester B Sc Electronics

Course Title: ELE - CT2: **ANALOG AND DIGITAL 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. Understand and study the behaviour of the semiconductor devices ie., I-V characteristics of various MOSFET devices the knowledge can be extended for understanding the behaviour /characteristics/ response of unknown / novel devices.
2. Applying the standard device models to explain/calculate critical internal parameters of semiconductor devices.
3. Understanding and characterizing the behaviour of known/unknown/novel power electronic devices such as UJT, SCR, Diac, Triac etc.
4. Acquainting and familiarization of the experimental skills to determine the behaviour of semiconductor devices.
5. Capable of analyzing the device characteristics and responses.
6. Understanding the working of basic logic gates, concepts of Boolean algebra and techniques to reduce/simplify Boolean expressions and their applications.
7. Synthesizing and Analyzing combinatorial and sequential circuits and their applications in electronics

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

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

ELE - CT2: ANALOG AND DIGITAL ELECTRONICS **56 Hrs**

Content

UNIT – 1 **14 Hrs**

Varactor diode, Schottky diode, Tunnel diode - construction, characteristics, working, symbol, and applications for each.

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: 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 **14 Hrs**

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

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 Band passButterworth 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 Monostablemultivibrator circuits. (Numerical Examples wherever applicable).

UNIT – 3 **14 Hrs**

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: SOP and POS, Minterm, Maxterm, SSOP, SPOS, Simplification of Boolean expressions, K-Map for 3 and 4 variables. Half Adder, Full Adder, Half Subtractor, Full Subtractor. 4-bit parallel binary adder, 2-bit and 4-bit magnitude 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.
Digital to Analog Converter: DAC with binary weighted resistor and R-2R resistor ladder

network. Analog to Digital converter: Successive approximation method-performance characteristics.

UNIT – 4 **14 Hrs**

Sequential Logic Circuits: Flip-Flops - SR Latch, Level and Edge Triggered concept, Clocked RS, D, JK and T Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. Master- Slave JK Flip-Flops. Applications of Flip-Flops in semiconductor memories, RAM, ROM and types.

Registers and Counters: Types of Shift Registers (up to 4-bits), its applications. Ring counter, Johnson counter applications. Asynchronous Counters: Logic diagram, Truth table and timing diagrams of 4-bit ripple counter, modulo-n counters, 4-bit Up-Down counter, Synchronous Counter: 4-bit counter, Design of Mod 3, Mod 5 and decade Counters using K-maps.

Suggested References:

1. Robert L Boylestad, "Introductory circuit analysis", 5th edition., Universal Book 2003.
2. Electronic Devices Conventional Current Version by Thomas L. Floyd, 10th edition, Pearson, 2018
3. David A. Bell "Electronic Devices and Circuits", 5th Edition, Oxford Univesity Press, 2015
4. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edn., Prentice Hall., 2000
5. Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, Oxford University Press. 2011,
6. R S Sedha, "A Text book of Applied Electronics", 7th edn., 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 Edition, TMH, 2011.
9. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, PHI Learning Pvt. Ltd. 2009
10. Digital Circuits and Systems, K R Venugopal and K Shyla, Tata McGraw Hill, 2011
11. Digital Circuits and systems, Venugopal, Tata McGraw Hill. 2011
12. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, PHI Learning. 2001
13. Digital Principles, Schaum's Outline Series, R. L. Tokheim, TMH., 1994
14. Digital Electronics, S.K. Mandal, 1st Edition, McGraw Hill., 2010.

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: Second Semester B Sc Electronics

Course Title: ELE-CP2: **ANALOG AND DIGITAL ELECTRONICS - Lab**	Course Credits: 2
Total Contact Hours: 56 Hrs	Duration of ESA: 4 Hrs
Formative Assessment Marks: 25 marks	Summative AssessmentMarks: 25 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.

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.	**x**					
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.	**x**					

Course Content: Second Semester B Sc Electronics

ELE-CP2: ANALOG AND DIGITAL ELECTRONICS – Lab

(Hardware and Circuit Simulation Software)

Content

Minimum Six Experiments to be performed in each Part

PART - A (Any SIX)

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, subtractor and 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 bridge and 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. Astable multivibrator using IC - 555 timer.
13. Monostable multivibrator using IC-555 timer.

PART – B (Any SIX)

1. Half Adder and Full Adder using (a) logic gates (b) using only NAND gates.
2. Half Subtractor and Full Subtractor (a) logic gates (b) using only NAND gates.
3. 4 bit parallel binary adder and Subtractor using IC7485.
4. Study of BCD to decimal decoder using IC7447
5. Study of the Encoders and priority encoders.
6. Study of Multiplexer and Demultiplexer using ICs.
7. Study of 2-bit and 4-bit magnitude comparators.
8. Study of Clocked RS, D and JK Flip-Flops using NAND gates.
9. Study of 4-bit asynchronous counter using JK Flip-Flop IC7476, modify to decadecounter and study their timing diagrams.
10. Study of 4-bit Shift Register – SISO, modification to ring counter using IC 7495.
11. Digital to Analog converter using binary weighted resistor method, determination of resolution, accuracy and linearity error.

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

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

Course Content: Second Semester B Sc Electronics

Course Title: ELE-OE 2.1: **CONSUMER ELECTRONICS**	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.

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.	**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.	**x**					

Course Content: Second Semester B Sc Electronics

ELE-OE 2.1: CONSUMER ELECTRONICS **45 Hrs**

Content
UNIT – 1 12 Hrs
Audio Systems: PA system, Microphones, Amplifier, Loudspeakers, Radio Receivers, AM/FM, Audio Recording, and reproduction, Installation of Audio/Video systems – site preparation, electrical requirements, cables and connectors. Study of PA systems for various situations – Public gathering, Closed theatre / Auditorium,Conference room, Prepare bill of material (Costing)
UNIT – 2 10 Hrs
TV and Displays: set top box, CATV and Dish TV, LCD, Plasma, LED,OLED, QDLED and LED TV, Projectors: DLP, Home Theatres, Remote controls.
UNIT – 3 10 Hrs
Landline and Mobile Telephony: Mobile Phones, Smart Phone, Smart Watch, GPRS and Bluetooth, GPS Navigation system. Office Equipment: Scanners,Barcode / flat bed, printers, Xerox, Multifunction UNITs (Print, Scan, and copy)
UNIT – 4 13Hrs
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. Market survey of products (at least one from each module). Identification of block and tracing the system, Assembly and Disassembly of system using toolkit.

Suggested References:

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

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: Second Semester B Sc Electronics

Course Title: ELE-OE 2.2: **INDUSTRIAL ELECTRONICS**	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.

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.						

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: Second Semester B Sc Electronics

ELE-OE 2.2: INDUSTRIAL ELECTRONICS **45 Hrs**

Content	
UNIT – 1	15 Hrs
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	15 Hrs
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:** Construction, working and applications of Lowpass, High pass, Band pass, Band reject and all pass filters. Phase-shift and Wein bridge oscillator using op-amp (Circuit diagram and formula only).	
UNIT – 3	15 Hrs
Transducers: Transducers, types, working of transducers., Displacement transducers - Resistive (Potentiometric, Strain Gauges – Types, Gauge Factor, bridge circuits, Semi-conductor strain gauge), Capacitive (diaphragm), Hall effect sensors, Magnetostrictive 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: 4bit 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).	

Suggested References

1. Analog Electronics: Devices and Circuits., B. C. Sarkar and S. Sarkar, 1st Edition, Damodar Group publisher., 2016
2. Measurement Systems, Doeblin., 4th edition, TMH, New York, 1992.
3. Electrical Measurements & Electronic Measurements., A.K. Sawhney., Dhanpat Rai & Co. (P) Limited., 2015
4. Digital Electronics: Circuits and Systems, B. C. Sarkar and S. Sarkar, S U T Prakashani Burdwan, 2018
5. Instrumentation- Devices and Systems., Rangan, Sarma, and Mani, 2nd Edition., Tata-McGrawHill., 2008
6. Electronic Instrumentation., H.S Kalsi, 3rd Edition., McGraw Hill., 2017
7. Instrumentation measurements and analysis., Nakra & Choudhary., 3rd Edition., TMH., 2017
8. Op-Amps and Linear IC's, R. A. Gayakwad, 4th Edition., Pearson Education., 2000
9. Electronic Sensor Circuits and Projects, III Volume, Forrest M Mims, Master Publishing Inc., 2006.
10. Timer, Op Amp, and Optoelectronic Circuits & Projects, Forrest M Mims, 1st Edition., Master Publishing Inc., 2004.

Course Content: Second Semester B Sc Electronics

Course Title: ELE-OE 2.3: **C PROGRAMMING AND INTERFACING WITH ARDUINO**	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 understand the programming techniques and computer skills

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.						
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**					
Capability to understand the programming techniques and computer skills	**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 2.3: C PROGRAMMING AND INTERFACING WITH ARDUINO 45 Hrs

Content
UNIT – 1 12 Hrs
Basics of 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, bit wise operators, expressions and evaluation of expressions, type cast operator, implicit conversions, precedence of operators. Arrays-concepts, declaration, accessing elements, storing elements, two-dimensional and multi-dimensional arrays. Input output statement–sprintf(), scanf() & getch()) and library functions (math and string related functions).
UNIT – 2 13 Hrs
Decision making, branching & looping Decision making, branching and looping: if, if-else, else-if, switch statement, break, for loop, while loop and do loop. Functions: Defining functions, function arguments and passing, returning values from functions, exampleprograms. Structures and unions defining and declaring structure variables, accessing structure members, initializing a structure, copying and comparing structure variables, array of structures, arrays within structures, structures within structures, structures and functions. Unions-size of structures, bit fields, example programs.
UNIT – 3 20 Hrs
Introduction to Microcontrollers: Common features of Microcontroller, Different types of microcontroller, Introduction to Arduino, Pin configuration and architecture, Device and platform features, Concept of digital and Analog ports, Familiarizing with Arduino Interfacing Board, Introduction to Embedded C and Arduino platform, Arduino i/o Functions, Pins Configured as INPUT, Pull-up Resistors, Pins Configured as OUTPUT, pin Mode() Function, digital Write() Function, Analog Read() function , Arduino Interrupts, Arduino Time - Incorporating Arduino time, delay() function, delay Micro-seconds() function, Millis() function, Micros() **Arduino Displays:** Working with Serial Monitor, Line graph via serial monitor, Interfacing a 8 bit LCD to Arduino, Fixed one line static message display, Runningmessage display, Using the LCD Library of Arduino. **Arduino Sensors:** Arduino – Humidity Sensor, Arduino – Temperature Sensor, Arduino – Water Detector / Sensor**,** Arduino – PIR Sensor**,** Arduino – Ultrasonic Sensor**,** Arduino – Connecting Switch (Magnetic relay switches)

Suggested References

1. Programming in ANSI C, Balagurusamy, 2nd Edition, TMH, 1992
2. Exploring Arduino, Jeremy Blum, 2nd Edition., Wiley,2019
3. Beginning Arduino, Technology in Action, Michael McRobetrs, APress., 2nd Edition., 2013
4. Beginning Arduino Programming, Brian Evans, Technology in Action
5. Practical Arduino Engineering, Harold Timmis, Technology in Action, 2011.
6. Practical Arduino : Cool Projects for open source hardware, Jonathan Oxer, Hugh Blemings, Technology in Action., 1st edition, apress., 2009

Course Content: Second Semester B Sc Electronics

Course Title: ELE-OE 2.4: **MOBILE COMMUNICATION**	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 understand the modern communication devices and technology.

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 modern communication devices and technology.	**x**					

Course Content: Second Semester B Sc Electronics

ELE-OE 2.4: MOBILE COMMUNICATION **45 Hrs**

Content
UNIT – 1 10 Hrs
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 20Hrs
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. Wireless LAN, Infrared vs radio transmission, Bluetooth: user scenarios and architecture. Basic concepts of 2G,3G, 4G/ LTE, 5G.
UNIT – 3 15 Hrs
Introduction to telecommunicating system- GSM: mobile services (Bearer services, tele-services, supplementary services), system architecture (radio subsystem, network and switching subsystem, operation sub system) Satellite system: history, application, basics, routing, localization and handover- Broadcast system: digital audio broadcasting, digital video broadcasting (basic concepts).

Suggested References;

1. Rapapport T. S, 'Wireless Communication Principles and Practices',3rd Edition., Pearson Education Asia, New Delhi 2003.
2. Mobile Communication, Jochen Schiller, 'Pearson Education, Asia. 2nd Edition, Pearson, 2008
3. Principles and Applications of GSM'Vijay K Garg, Joseph E Wilkes, 1st Edn, Pearson Edu.1999

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

Course Title: ELE-OE 2.5: **MOBILE App DEVELOPMENT**	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 2.5: MOBILE App DEVELOPMENT **45 Hrs**

Content
UNIT – 1 15 Hrs
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 Software Development 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, The Values Folder, Leveraging Android XML, Screen Sizes, Launching Your Application: TheAndroidManifest.xml File, Creating Your First AndroidApplication.
UNIT – 2 15 Hrs
Android Framework Overview: The Foundation of OOP, The APK File, Android Application Components, Android Activities: Defining the User Interface, Android Services: Processing in the Background, Broadcast Receivers: Announcements and Notifications, Content Providers: Data Management, 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 for and Handling Events, Handling UI Events via the View Class, Event call back methods, Handling Click Events, Touch screen Events, Keyboard Events,Context Menus, Controlling the Focus.
UNIT – 3 15 Hrs
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 iOS application development. **Windows Phone Environment:** Overview of windows phone and its platform, Building windows phone application **.** **Compulsory activity:** *Development of mobile App*

Suggested References

1. Beginning Android 4, Onur Cinar, Apress Publication, 2012
2. Professional Android 4 Application Development, Reto Meier, 2nd Edition, Wrox Publisher, 2012
3. Beginning iOS 6 Development: Exploring the iOS SDK, David Mark, 1st Edition, Apress, 2013
4. Beginning Windows 8 Application Development, IstvánNovák, ZoltanArvai, György Balássy and David Fulop, Wiley, 2012.
5. Professional Windows 8 Programming: Application Development with C# and XML, Allen Sanders and Kevin Ashley, John Wiley & Sons, 2012

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 2.6: Digital Systems 45 Hrs

Course Title: ELE-OE 2.6: Digital Systems	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:

6. Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research.
7. To acquire experimental skills, analysing the results and interpret data.
8. 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.
9. Capacity to identify and implementation of the formulate to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.
10. 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 2.6: Digital Systems **45 Hrs**

Unit 1 **20Hrs**

Combinational logic circuits: Definition, applications. Half Adder: Symbol, Logic circuits using XOR and basic gates, Truth table, Full Adder: Symbol, Logic circuits using XOR and basic gates, Truth table, Half Subtractor: Symbol, Logic circuits using XOR and basic gates, Truth table. Full Subtractor: Symbol, Logic circuits using XOR and basic gates, Truth table. Adder – Subtractor; Logic circuit, Pin diagram IC 7483, IC 7486. Parallel Adder: 4 –bit parallel binary adder, BCD adder, IC 7483 NAND – NOR implementation of Adders.

Unit 2 **25Hrs**

Sequential Circuits: Importance of clock in digital circuit and introduction to flip flop. Flip –flop-difference between latch and flip-flop. Qualitative study of level and edge triggering. RS latch /unlocked, symbol and truth table. RS flip-flop using NAND gate, symbol, truth table and timing diagram. D flip –flop – Symbol, truth table, Realization of JK flip –flop using NAND gates, working, and timing diagram. Race around condition, present and clear inputs, pin diagram of IC 74112. T flip flop-Logic symbol, JK flip flop as a T flip –flop truth table and timing diagram. Master slave flip flop; Logic circuit, truth table and timing diagram, advantage of M/S flip-flop, pin diagram of IC 7473 IC 7476. Registers: Definition, types of registers-Serial in serial out, serial in parallel out, Parallel in serial out, Parallel in parallel our shift register (Block diagram representation for each), truth table, timing diagram and speed comparison.

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**