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-bridgeoscillator – (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**					

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**

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 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**