Rayat Shikshan Sanstha's

Yashavantrao Chavan Institute of Science, Satara

Department of Electronics

Syllabus for Bachelor of Science (Electronics) Part I

1. **SUBJECT: Electronics**

2. **YEAR OF IMPLEMENTATION:** New Syllabi for the B.Sc. I Electronics will be implemented from June 2018 onwards.

3. **PREAMBLE:**

Bachelor of Science is an integrated academic degree in faculty of Science. The faculty is not ignoring the developments in the field of Electronics. The revision of existing syllabus of Electronics subject in science faculty is essential. This is a humble endeavor to initiate the process towards an era of knowledge. The students from science faculty should also be competent for this change in the technology.

In this year, a student will able to understand handling of laboratory equipments, build Electronics circuits with confidence. In the subject, the student will also get a basic and proper knowledge in the field of Embedded System design

4. **GENERAL OBJECTIVES OF THE COURSE:**

1. To create graduates with sound knowledge of fundamentals of Electronics, who can contribute towards advancing science and technology.
2. To create graduates with sufficient capabilities in Electronics who can become researchers and developers to satisfy the needs of the core Electronics industry.
3. To develop ability among students to formulate, analyze and solve real life problems faced in Electronics industry.
4. To provide opportunity to students to learn the latest trends in Electronics and make them ready for life-long learning process.
5. To make the students aware of professional ethics of the Industry, and prepare them with basic soft skills essential for working in community and professional teams.
6. To prepare the students for graduate studies through competitive examinations, enabling them to reach higher echelons of excellence
7. To produce electronic professionals who can be directly employed or start his/her own work as Electronic circuit Designer, Electronics consultant, testing professional, Service engineer and even an entrepreneur in electronic industry.

5. **DURATION:**

03 Years (Full Time)

6. **PATTERN:**

SEMESTER EXAM (CBCS)

7. **MEDIUM OF INSTRUCTIONS:**

ENGLISH

8. STRUCTURE OF COURSE:

1. FIRST SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		PAPER NO & Paper Code	No. of lectures per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-I: BET101 Paper-II: BET102	5	4	Practical Paper – I : BEP103	4	2

2. SECOND SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		PAPER NO & Paper Code	No. of lectures Per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-III: BET201 Paper-IV: BET202	5	4	Practical Paper – II : BEP203	4	2

3. Structure and Title of Papers of B. Sc. Course:

- **B. Sc. I Semester I**

Paper I: Basic Circuit Theory and Network Analysis
Paper II: Semiconductor Devices

- **B. Sc. I Semester II**

Paper III: Digital Electronics
Paper IV: Electronic Circuits

4. OTHER FEATURES:

A. LIBRARY:

- **REFERENCE BOOKS**

1. R. S. Sedha, Textbook of Applied Electronics, S. Chand Publication
2. Soni and Gupta, Network Analysis,
3. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill (2004)
4. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill.(2005)
5. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)
6. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill(2005)

7. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)
8. S. M. Sze, Semiconductor Devices: Physics and Technology, 2nd Edn, Wiley India edition (2002).
9. Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006)
10. Dennis Le Croissette, Transistors, Pearson Education (1989)
11. Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons (2001)
12. Kanaan Kano, Semiconductor Devices, Pearson Education (2004)
13. Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education (2006)
14. M. Morris Mano Digital System Design, Pearson Education Asia, (Fourth Edition)
15. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
16. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India(2000)
17. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
18. Electronic Devices and circuit theory, Robert Boylestad and Louis Nashelsky, 9th Edition, 2013, PHI
19. Electronic devices, David A Bell, Reston Publishing Company
20. D. L. Schilling and C. Belove, Electronic Circuits: Discrete and Integrated, Tata McGraw Hill (2002)
21. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw Hill (2002)
22. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
23. J. R. C. Jaegar and T. N. Blalock, Microelectronic Circuit Design, Tata McGraw Hill (2010)
24. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)
25. Allen Mottershed, Electronic Devices and Circuits, Goodyear Publishing Corporation

- **JOURNALS AND PERIODICALS**

1. Journal of Instrument Society of India
2. Express Computer
3. Embedded For You
4. Electronics Maker
5. Electronics For You
6. PCQUEST
7. Digit

B. <u>SPECIFIC EQUIPMENTS:</u>

Computers, Laptops, Printers, Scanners, LCD Projectors, E- Podium, Smart Board, Document Camera, Visualizer

C. <u>LABORATORY EQUIPMENTS</u>:

1. Digital storage Oscilloscope: 60 MHz
2. Signal generator
3. Microwave Test bench (Gunn Source)
4. Antenna Trainer
5. Arduino Development Board
6. CPLD development boards

7. Microcontroller Boards – 8051, MSP430, PIC18F, AVR MEGA32, ARDUINO NANO, UNO, MEGA
8. KEIL - IDE
9. Mikro C Compilers for 8051, PIC and ARM
10. Soft Computing Tools – SCILAB, MATLAB
11. PCB Designing Tool: DipTrace

B.Sc. Part I: **Electronics**

Semester I
Paper I
BET101: Basic Circuit Theory and Network Analysis

- **Learning Objectives:**
  1. To learn basic electronics circuits, their construction, working and characteristics.
  2. To study the ac and dc circuit analysis methods
  3. To study the resonance and resonant circuits
  4. To study of passive electronic filters
  5. To learn different laws and theorems to minimize complex circuit to simplified circuits

Unit I: Circuit Elements **10L**

Electric circuit, Active and Passive elements, Bilateral and unilateral element, Linear and non-linear element, Lumped and distributed element.

Resistors: Classification of resistors (Quantitative), Color coding of resistors, resistors in series and parallel, testing of resistance using multimeter.

Capacitors: Principles of capacitance, Permittivity, Dielectric Constant, Dielectric strength, Energy stored in a capacitor, Charging and discharging of a capacitor, leakage current in capacitor, stray capacitance.

Classification of capacitor (Quantitative), Color coding of capacitor, applications of Capacitors, capacitors in series and parallel, factors governing the value of capacitors, testing of capacitors using multimeter.

Inductors: Inductor, Types of inductors, Self and mutual inductance, Faraday's law and Lenz's law of electromagnetic induction, Energy stored in an inductor, Q factor, Applications of inductors, Inductance in series and parallel, testing of inductance using multimeter.

Transformer: Principle and construction of transformer, Specification of transformer. Types of Transformer: Step-up, step-down, current Transformer, Pulse transformer, auto transformer etc.

Relays: Principle, construction and working of electromagnetic or solid state relays.

Types of Switches: SPDT, DPDT etc. (Explanation using Symbols)

Unit II: Circuit Analysis **08L**

Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Node Analysis, Mesh Analysis, Star-Delta network, Star-Delta Conversion

DC Transient Analysis: RC Circuit- Charging and discharging with initial charge, RL Circuit with Initial Current, Time Constant, RL and RC Circuits with Sources, DC Response of Series RLC Circuits.

Unit III: AC Circuit Analysis **08L**

AC, DC Sources, Voltage and Current Sources, direction of current and voltage

Definition of Instantaneous, Peak, Peak to Peak, Root Mean Square and Average Values, Phase, Phase Difference, Voltage-Current relationship in Resistor, Inductor and Capacitor, Phasor, Complex Impedance

Power in AC Circuits: Instantaneous Power, Average Power, Reactive Power, Power Factor. Sinusoidal Circuit Analysis for RL, RC and RLC Circuits

Resonance in Series and Parallel RLC Circuits, Frequency Response of Series and Parallel RLC Circuits, Quality (Q) Factor and Bandwidth
Passive Filters: Low Pass, High Pass, Band Pass and Band Stop (Qualitative only)

Unit IV: Network Theorems **10L**

Principal of Duality, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Millman's Theorem, Maximum Power Transfer Theorem. AC circuit analysis using Network theorems
Two Port Networks: Impedance (Z) Parameters, Admittance (Y) Parameters, Hybrid (H) Parameters and their Interconversions. Definitions of Twin T and Ladder Network

Reference Books:

1. R. S. Sedha, A Textbook of applied electronics, S. Chand Publication
   (Page No.: Unit I: 100-135, 136-142, 145-149, Unit II: 72-76, Unit III: 92-99, 157-171, Unit IV: 76-91**)**
2. A. Sudhkar and S. P. Shyammohan, Circuits and Networks Analysis and Synthesis, Tata McGraw-Hill Publishing Company Limited
   (Page No.: Unit I: 3-6, Unit II: 11- 23, 49-64, 86-90, 428-441, Unit III: 166-176, 217-228, Unit IV: 90-102, 110-113, 228-236, 556-564**)**
3. B. L. Thereja, Basic Electronics Solid State, S. Chand & Company LTD
   (Page No.: Unit I: 40-82, Unit II: 25-28, Unit III: 125-130, 97-107, Unit IV: 29-39**)**
4. Soni & Gupta, A course in Electrical Circuits Analysis, Dhanpat Rai & Sons.
   (Page No.: Unit II: 7-10, 145-174, Unit IV: 3-57, 43-58**)**
5. Charles K. Alexander, Matthew N. O. Sadiku, Fundamentals of Electric Circuits, McGraw-Hill Education (INDIA) PVT.LTD
   (Page No.: Unit I: 215-234 Unit II: 37-43, 82-106, 415-420, 253-265, 421- 427, Unit III: 637-642) Unit IV: 129-168, 421-427**)**
6. B. L. Thereja, A. K. Thereja, Electrical Technology Volume 1 Basic Electrical Energy, S. Chand & Company LTD
   (Page No.: Unit I: 214-255, Unit II: 53-78, Unit III: 457-486, 93-112, Unit IV: 113-165**)**
7. Schaum's outline series, Theory and Problems of Electric Circuits, McGraw-Hill Book Company
   (Page No.: Unit II: 26-28, Unit III: 88-113, 169-174, Unit IV: 39-44, 117- 118**)**

Learning Outcomes:

Students should demonstrate their ability to:
Unit 1. Identify all components and understand basic circuit theory
Unit 2. Interconversion of star delta conversion
Unit 3. AC and DC analysis of circuits
Unit 4. Minimize complex electronic circuits to simple one using various network theorems
Design and analyze mathematical relationships in circuit.

Semester I

Paper II
BET102: Semiconductor Devices

- **Learning Objectives:**
  1. To learn the basics of a semiconductor materials.
  2. To study the carries transport phenomena in semiconductors
  3. To study PN junction and PN junction diode
  4. To learn various types of semiconductor devices their construction, working and characteristics

Unit I: Semiconductor Basics **10L**

Conductor, Semiconductor, Insulator, Introduction to Semiconductor Materials, Crystal Structure, Planes and Miller Indices, Energy Band in Solids, Concept of Effective Mass, Density of States, Carrier Concentration at Normal Equilibrium in Intrinsic Semiconductors, Fermi Level for Intrinsic & Extrinsic Semiconductors, Dependence of Fermi Level on Temperature and Doping Concentration, Temperature Dependence of Carrier Concentrations.
Carrier Transport Phenomena: Carrier Drift, Mobility, Resistivity, Hall Effect, Diffusion Process, Einstein Relation, Current Density Equation, Carrier Injection, Generation and Recombination Processes, Continuity Equation.

Unit II: P-N Junction Diode **08L**

Formation of Depletion Layer, Space Charge, Electrostatic Potential Difference at Thermal Equilibrium, Depletion Width and Depletion Capacitance of an Abrupt Junction, Concept of Linearly Graded Junction, Derivation of Diode Equation and I-V Characteristics, Idea of Static and Dynamic Resistance, Q point and DC Load Line
Zener and Avalanche Breakdown Mechanism, Zener diode as voltage regulator, LED, photodiode Schottky diode, Tunnel diode, point contact diode, Varactor diode
Solar cell: circuit symbol, characteristics and applications

Unit III: Bipolar Junction Transistors (BJT) **10L**

PNP and NPN Transistors, Basic Transistor Action, Emitter Efficiency, Base Transport Factor, Current Gain, Base-Width Modulation, Modes of operation, Regions of Operation, Input and Output Characteristics of CB, CE and CC Configurations, Current gains α and β, DC load line and Q point, stability, stability factors, Leakage Currents in transistor and their relations, Parameters of BJT (H, Y and Z)
Metal Semiconductor Junctions: Ohmic and Rectifying Contacts.

Unit IV: Field Effect Transistors **08L**

JFET: Type of FET, Symbol, Construction, Idea of Channel Formation, Pinch-Off and Saturation Voltage, Current-Voltage Output Characteristics, Parameters of FET.
MOSFET: types of MOSFETs, symbols, Working and Characteristic curves of Depletion type MOSFET (both N channel and P Channel) and Enhancement type MOSFET (both N channel and P channel). Complimentary MOS (CMOS), FET as Switch
Power Devices: UJT, Basic construction and working, Equivalent circuit, intrinsic Standoff Ratio, Characteristics and relaxation oscillator-expression, SCR, Construction, Working and Characteristics, Triac, Diac, IGBT, MESFET, Circuit symbols, Basic constructional features, Operation and Applications

Reference Books:

1. R. S. Sedha, Textbook of Applied Electronics, S. Chand Publication
   (Page No.: Unit I: 173-207, Unit II: 208-230, 248-284, Unit III: 299-329, Unit IV: 342-364, 371-388**)**
2. Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006)
   (Page No.: Unit I: 21-28, 90, 100, 110, 127, 130, Unit II: 207-243, 434-451, Unit III: 371-378, 417-421, Unit IV: 282-287, 321-352**)**
3. S. M. Sze, Semiconductor Devices: Physics and Technology, 2ndEdition, Wiley India edition (2002).
   (Page No.: Unit I: 17, 48, 57, Unit II: 85-123, Unit III: 131-150, Unit IV: 169-198.
4. Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons (2001)
   (Page No.: Unit I: 1-12, Unit II: 146-160, 178-197, Unit III: 248-259, Unit IV: 356-361, 433-464**)**
5. Dennis Le Croissette, Transistors, Pearson Education (1989)
   (Page No.: Unit I: 43-61, Unit II: 62-86, Unit III: 112-126, 136-139**)**
6. B. L. Thereja, Basic Electronics Solid State, S. Chand & Company LTD
   (Page No.: Unit I: 142-150, Unit II: 208-230, 248-284, Unit III: 299-329, Unit IV: 342-364, 371-388**)**
7. Kanaan Kano, Semiconductor Devices, Pearson Education (2004) **(Unit 1, 2, 3, 4)**
8. Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education (2006) **(Unit 1, 2, 3, 4)**

Learning Outcomes:

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

Unit 1. Know basics terms and their importance for studying semiconductors
Unit 2. Make use of PN junction diodes in electronic circuits
Unit 3. Analyze the characteristics of semiconductor devices.
Unit 4. Understand the performance wise application areas of semiconductor devices.

Semester I
Practical I
BEP103: Basic Circuit Theory, Network Analysis and Semiconductor Devices Lab (Hardware and Circuit Simulation Software)

- **Learning Objectives:**

1. To learn basic electronics circuits.
2. To learn their construction, working and characteristics.
3. To learn different laws and theorem for solving complex circuit to simplified circuit
4. To learn the principles of a semiconductor materials.
5. To learn I-V characteristics & applications of diode and other Semiconductor devices.

GROUP A

1. Familiarization with
    a. Resistance in series, parallel and series – Parallel.
    b. Capacitors & Inductors in series & Parallel.
    c. Multimeter – Checking of components.
    d. Voltage sources in series, parallel and series – Parallel
    e. Voltage and Current dividers
2. Study of CRO: Measurement of Amplitude, Frequency & Phase difference.
3. Verification and Study of Network theorems:
    a) Kirchhoff's Laws.
    b) Norton's theorem.
    c) Thevenin's Theorem.
    d) Superposition Theorem.
    e) Reciprocity Theorem.
    f) Maximum Power Transfer Theorem.
    g) Millman's Theorem
4. Study and applications of RC Circuits:
    a) Time Constant
    b) RC Differentiator and Integrator.
    c) Designing of passive filters and study of their Frequency Response (Low Pass/ High Pass)
5. Study of the a Series and Parallel LCR Circuit and determine:
    a) Resonant Frequency
    b) Impedance at Resonance
    c) Quality Factor Q
    d) Band Width.

Reference Books:

1. R. S. Sedha, Textbook of Applied Electronics, S. Chand Publication
2. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill (2004)
3. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill.(2005)
4. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)
5. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill (2005)
6. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)

GROUP B

1. Study of Hall Effect.
2. Study of I-V Characteristics of:
    a) PN Junction Diode
    b) Zener Diode.
    c) Solar Cell
3. Study of I-V Characteristics of:
    a) CE configuration of BJT and obtain ri, ro, β.
    b) CB configuration of BJT and obtain ri, ro, α.
    c) CC configuration of BJT and obtain voltage gain, ri, ro.
4. Study of I-V Characteristics of FET:
    a) N channel
    b) P Channel
    c) MOSFET.
5. Study of I-V Characteristics of the UJT.
6. Study of I-V Characteristics of the SCR.

Reference Books:

1. R. S. Sedha, Textbook of Applied Electronics, S. Chand Publication
2. S. M. Sze, Semiconductor Devices: Physics and Technology, 2ndEdition, Wiley India edition (2002).
3. Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006)
4. Dennis Le Croissette, Transistors, Pearson Education (1989)
5. Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons (2001)
6. Kanaan Kano, Semiconductor Devices, Pearson Education (2004)
7. Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education (2006)

- **Learning Outcomes:**

Students should demonstrate their ability to:

1. Design & analyze basic electronics components and circuit.
2. Understand the basic theory & mathematical relationships in circuit analysis.
3. Simplify complex Electronics circuits.
4. Analyze the characteristics of semiconductor devices.
5. Understand the performance wise application areas of semiconductor devices.

Semester II
Paper III
BET201: Digital Electronics

- **Learning Objectives:**

1. To educate the students about various number systems
2. To learn Boolean algebra and logic gates
3. To study digital logic families and their important features
4. To develop designing and analyzing attitude about sequential circuits
5. To develop designing and analyzing attitude about combinational circuits

Unit I: Number System and Codes 10L

Decimal, Binary, Hexadecimal and Octal number systems, base conversions, Binary, octal and hexadecimal, arithmetic (addition, subtraction by complement method, multiplication), representation of signed and unsigned numbers, BCD, ASCII code etc.
Boolean algebra and Logic Gates: Introduction to Boolean Algebra and Boolean operators, Study of OR, AND, NOT gates, Basic postulates, construction and symbolic representation of XOR, XNOR, Universal (NOR and NAND) gates. DeMorgan's Theorem and fundamental theorems of Boolean algebra
Digital Logic families: Fan-in, Fan out, Noise Margin, Power Dissipation, Noise, Figure of merit, Speed power product, TTL and CMOS families and their comparison.

Unit II: Combinational Logic Design and Analysis 08L

Standard representation of logic functions (SOP and POS), Karnaugh map minimization, Encoder and Decoder, Multiplexers and Demultiplexer, Implementing logic functions with multiplexer
Arithmetic Circuits: Binary addition, Adder (Half and Full), Subtractor (Half and Full) parallel adder/subtractor

Unit III: Sequential Logic Design 10L

Latches and Flip flops, S-R Flip flop, J-K Flip flop, T and D type Flip flop, Clocked and edge triggered Flip flops, master slave flip flop
Counters: Synchronous and asynchronous and modulo-N, State Table, State Diagrams, counter design using excitation table and equations, Ring counter and Johnson counter, Decade Counter.
Shift registers: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers

Unit IV: Computer Organization and Programmable Logic Devices 08L

Computer Organization, Memory: Memory, RAM, ROM, Types: SRAM, DRAM, PROM, EPROM, UV-EPROM, EEPROM, FLASH
Programmable logic devices: Introduction to PLA, PAL, PLD, CPLD, FPGA, ASIC

Reference Books:

1. M. Morris Mano, Digital System Design, pearson Education Asia,(Third edition) **(Page No.:** Unit I: 1-27, 37-40, 54, Unit II: 119-141, Unit III: 172-180, 217-239, Unit IV: 255-283**)**
2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994) **(Page No.:** Unit I: 28-64, 89-109, 132-142, Unit II: 156-169, 222-264, Unit III: 292 - 312, 327-362, 383-403), Unit IV: 422-457**)**

3. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India(2000)
(Page No.: Unit I: 18-36, 70-81, Unit II: 241, 254, Unit III: 261-270, Unit IV: 278-290**)**
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
(Page No.: Unit I: 21-27, 31-38, 43-47, 57-60, 77, 122-125, Unit II: 64-67, 125-130, 231-239, Unit III: 154-160, 209-213, Unit IV: 260-281**)**

Learning Outcomes:

Students should demonstrate their ability to:

Unit 1. Convert any number from one number system to any other number system
Design and constructs logic as well as arithmetical circuits
Calculate various important parameters of Digital logic families
Unit 2. Design & analyze combinational logic circuits
Unit 3. Design & analyze sequential logic circuits
Unit 4. Analyze programmable logic devices

Semester II
Paper IV
BET202: Electronic Circuits

- **Learning Objectives:**

Student should learn different applications of active devices and their working:

1. To study and design all diode rectifier circuits and filtering techniques
2. To learn fixed and variable IC regulator.
3. For transistors biasing techniques and transistor power amplifiers
4. To learn feedback amplifiers and various oscillators
5. To learn the principles of circuit analysis and design.

Unit I: Diode Circuits **08L**

Rectifiers: HWR, FWR (center tapped and bridge). Circuit diagrams, working and waveforms ripple factor & efficiency, comparison. Filters: types, shunt, LC, CLC (π) filter (Qualitative analysis)
Zener diode as a regulator, circuit diagram and explanation for load and line regulation, disadvantages of Zener diode regulator.
Fixed and variable IC regulators: IC 78xx and IC 79xx, IC LM317 (output voltage equation), DC Power Supply Design.

Unit II: BJT Circuits **10L**

AC & DC Operating point, DC & AC load line, Need of transistor biasing & stability of Q point, Thermal Instability, Heat sink, Transistor biasing methods, Fixed bias, collector to base bias, voltage divider bias and emitter bias (+VCC and –VEE bias), Temperature Compensation using single & double diode, Transistor rating & specifications Typically SL-100, BC148, BC548 etc. Transistor as a switch, Transistor as series & Shunt regulator, Darlington pair and its applications

Unit III: Power Amplifiers **10L**

Power Amplifiers: Difference between voltage and power amplifier, classification of power amplifiers, Class A, Class B, Class C and their comparisons.
Operation of a Class A single ended power amplifier. Operation of Transformer coupled Class A power amplifier, overall efficiency. Circuit operation of complementary symmetry Class B push pull power amplifier, distortion in power amplifier, crossover distortion, heat sinks
RC Coupled amplifier: Effect on gain and bandwidth for single stage CE amplifier, Cascaded CE amplifiers, two stage RC amplifiers and its frequency response.
RF tuned amplifiers: Circuit diagram, Working and Frequency Response for each, Limitations of RF tuned amplifier, Applications of tuned amplifiers in communication circuits.

Unit IV: Feedback Amplifiers and Oscillators **08L**

Concept of feedback, negative and positive feedback, General Characteristics of feedback circuits advantages and disadvantages of negative feedback, voltage, current feedback amplifiers (series and shunt), and gain, input and output impedances. Barkhausen criteria for oscillations, Study of phase shift oscillator, Colpitts oscillator, Hartley oscillator, Wien Bridge Oscillator and Crystal Oscillator.
Depletion and Enhancement MOSFET, Biasing of MOSFETs, Small Signal Parameters, Common Source amplifier circuit analysis

Reference Books:

1. R.S. Sedha, Textbook of Applied Electronics, S. Chand Publication
   (Page No.: Unit I: 427-462, 488-495, Unit II: 524-570, Unit III: 684-715, 716-726, Unit IV: 727-747, 779, 780-814**)**
2. Devid A Bell, Electronics Device, Reston Publishing Compny
   (Page No.: Unit I: 52-80, Unit II: 124-151,177, Unit III: 366, 428, 606-617, Unit IV: 422-428, 538-543**)**
3. Robert Boylestad and Louis Nashelsky, Electronics Devices and Circuits Theory, 9th Edition, 2013, PHI
   (Page No.: Unit III: 701-734, Unit IV: 440-447, 773-798**)**
4. Allen Mottershed, Electronic Devices and Circuits, Goodyear Publishing Corporation
   (Page No.: Unit 4: 378-393,304-307**)**
5. Donald Neamen, Electronic Circuit Analysis and Design, Tata McGraw Hill (2002)
6. J. Millman and C. C. Halkias, Integrated Electronics, TMH (2001) **(Unit 3)**

Learning Outcomes:

Students will be able to:

Unit 1. Design appropriate rectifier and filter circuits with necessary parameters
Design fixed and variable power supply using IC regulators

Unit 2. Design appropriate biasing and Q point stabilization technique for transistor amplifier

Unit 3. Build voltage and current power amplifier

Unit 4. Build feedback amplifier and oscillator for any frequency.
Explain basic electronics circuit concepts and its response.
Design basic electronic circuits.

Semester II
Practical II
BEP203: Digital Electronics and Electronics Circuits Lab
(Hardware and Circuit Simulation Software)

- **Learning Objectives:**

1. To learn Boolean algebra and logic gates
2. To develop designing and analyzing attitude about sequential circuits
3. To develop designing and analyzing attitude about combinational circuits
4. To learn fixed and variable IC regulators, principles of circuit analysis and design.
5. To study and design all diode rectifier circuits and filtering techniques
6. For transistors biasing techniques and transistor regulators
7. To learn feedback amplifiers and various oscillators
8. To learn the principles of circuit analysis and design.

GROUP A

1. Study of Number Systems, Codes and Logic circuits:
   a) Code converters (Binary to Gray and vice versa).
   b) 2 bit Magnitude comparator.
   c) Basic gates
   d) Verify and design AND, OR, NOT and XOR gates using NAND/NOR gates.
   e) Convert a Boolean expression into logic gate circuit and assemble it using logic gate IC's.
2. Design of Adder circuit:
   a) Half and Full Adder.
   b) Half and Full Subtractor.
3. Study of Multiplexer/Demultiplexer:
   a) Design 4 X 1 Multiplexer using gates.
   b) Demultiplexer using logic gates.
4. Study of Encoders and Decoders:
   a) Design a seven segment display driver.
   b) Decoder (2x4, 3x8), Encoders and Priority Encoders.
5. Study of Flip flops:
   a) Build a Flip- Flop Circuits using elementary gates. (RS, Clocked RS, D-type).
   b) Design a counter using D/T/JK Flip-Flop.
   c) Ripple counter.
   d) Design n-bit asynchronous counter using Flip-Flop ICs.
   e) Design a shift register and study Serial and parallel shifting of data.

Reference Books:

1. M. Morris Mano Digital System Design, Pearson Education Asia,(Fourth Edition)
2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
3. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India(2000)
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)

GROUP B

1. Study of Rectifier and Power supply desing:
   a) Half wave Rectifier – without and with shunt capacitance filter
   b) Centre tapped full wave rectifier – without and with shunt capacitance filter.
   c) Zener diode as voltage regulator – load regulation.
   d) Design of power supply using DC power supply with zener regulator.
   e) Designing of Fixed voltage power supply using IC regulators using 78xx series and 79xx series
   f) Design and testing of Transistor linear regulator
2. BJT amplifier circuits:
   a) Transistor characteristics in CE mode – determination of ri, ro and β.
   b) Study of Fixed Bias, Voltage divider and Collector-to-Base bias Feedback configuration for transistors.
   c) Design and study of voltage divider biasing.
   d) Designing of a Single Stage CE amplifier of given gain
3. Study of power amplifiers:
   a) Class A, B and C Power Amplifier.
4. Study of oscillator:
   a) Study of the Colpitt's Oscillator.
   b) Study of the Hartley's Oscillator.
   c) Study of the Phase Shift Oscillator
5. Study of the frequency response of Common Source FET amplifier.

Reference Books:

1. Electronic Devices and circuit theory, Robert Boylestad and Louis Nashelsky, 9th Edition, 2013, PHI
2. Electronic devices, David A Bell, Reston Publishing Company
3. D. L. Schilling and C. Belove, Electronic Circuits: Discrete and Integrated, Tata McGraw Hill (2002)
4. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw Hill (2002)
5. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
6. J. R. C. Jaegar and T. N. Blalock, Microelectronic Circuit Design, Tata McGraw Hill (2010)
7. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)
8. Allen Mottershed, Electronic Devices and Circuits, Goodyear Publishing Corporation

- **Learning Outcomes:**

Students should demonstrate their ability to:

1. Design construct logic as well as arithmetical circuits
2. Design & analyze combinational logic circuits
3. Design & analyze sequential logic circuits
4. Design appropriate rectifier and filter circuits with necessary parameters
5. Design fixed and variable power supply using IC regulators
6. Design appropriate biasing and Q point stabilization technique for transistor amplifier
7. Build feedback amplifier and oscillator for any frequeny.
8. Design basic electronic circuits.

Nature of Question Paper:

1. **CCE-I : Marks =10:**
   Unit 1: Descriptive short questions (2X5)

2. **CCE-II: Marks =10:**
   Unit 2 &3: Multiple choice questions: Online Examination: (1X10)

3. **ESE: Marks =50:**
   Unit 1 to 4:
   Q.1. Multiple Choice questions (1 X10)
   Q.2. Attempt any two out of three (2X10=20)
   Q.3. Attempt any four out of six (4X5=20)

(**CCE**- Comprehensive Continuous Evaluation, **ESE** – End Semester Examination)

1. STRUCTURE OF COURSE:

1. THIRD SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		PAPER NO & Paper Code	No. of lectures per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-V: BET301	6	4	Practical Paper – III: BEP303	8	4
		Paper-VI: BET302					

2. FOURTH SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		PAPER NO & Paper Code	No. of lectures Per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-VII: BET401	6	4	Practical Paper – IV: BEP403	8	4
		Paper-VIII: BET402					

3. Structure and Title of Papers of B. Sc. Course:

- **B. Sc. II Semester III**

Paper V: Analog Communication
Paper VI: Wave Shaping and Operational Amplifier

- **B. Sc. II Semester IV**

Paper VII: Digital Communication
Paper VIII: 8085 microprocessor and 8051 microcontroller

1. STRUCTURE OF COURSE:

1. FIFTH SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		PAPER NO & Paper Code	No. of lectures per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-IX: BET501	12	8	Practical Paper – V & VI (BEP 505 & BEP 506)	20	8
		Paper-X: BET502					
		Paper-XI: BET503 (Elective)					
		Paper-XII: BET504 (Elective)					

2. Structure and Title of Papers of B. Sc. Course:

- **B. Sc. III Semester V**

Paper IX: Embedded System Design
Paper X: Semiconductor Fabrication and Characterization
Paper XI: Elective 1
Paper XII: Elective 2

Elective 1:

1. Transmission Lines, Antenna and Wave Propagation
2. Antenna Theory and wireless Network

Elective 2:

1. Electronic Instrumentation
2. Verilog and FPGA based system design

3. SIXTH SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		PAPER NO & Paper Code	No. of lectures per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-XIII: BET601	12	8	Practical Paper – VII & VIII (BEP 605 & BEP 606)	20	8
		Paper-XIV: BET602					
		Paper-XV: BET603 (Elective)					
		Paper-XVI: BET604 (Elective)					

4. Structure and Title of Papers of B. Sc. Course:

- **B. Sc. III Semester VI**

Paper XIII: Digital Signal Processing
Paper XIV: Power Electronics
Paper XV: Elective 1
Paper XVI: Elective 2

Elective 1:

1. PIC Microcontrollers and Embedded Systems Design
2. Nanoelectronics

Elective 2:

1. Photonics
2. Electromagnetics

Mr. J. A. Wagh
Chairman
B.O.S. (Electronics)