Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College, Karad

(An Autonomous College, Affiliated to Shivaji University, Kolhapur.)

NEP-2020: Credit Framework for Faculty of Science

Subject Electronics

2024-25

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 Academic year 2024-25 according to NEP-2020 onwards.

3. **PREAMBLE:**

Bachelor degree in Electronics 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 according to the norms given in NEP-2020. This is a humble endeavor to initiate the process towards an era of knowledge. The students from this 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, IOT, PCB design and Robotics.

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:**

   3 or 4 Years (Full Time)

6. **PATTERN:**

   SEMESTER EXAM

7. **MEDIUM OF INSTRUCTIONS: ENGLISH**

STRUCTURE OF COURSE:

DSC (Discipline Specific 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 BET24-101 Paper-II: BET24-102	4	4	Practical BEP24-103	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: BET24-201 Paper-IV: BET24-202	4	4	Practical BEP24-203	4	2

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

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

Paper I: **Analog Electronics-I**
Paper II: **Digital Electronics-I**

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

Paper III: **Analog Electronics-II**
Paper IV: **Digital Electronics-II**

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. Allen Mottershed, Electronic Devices and Circuits, Goodyear Publishing Corporation

B. Sc. Part – I Semester – I Paper I

BET24-101: ANALOG ELECTRONICS-I

Theory: 30 hrs. (38 lectures of 48 minutes)

Marks-50 (**Credits: 02**)

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Identify and explain electrical components and determine the value of resistor, inductor and capacitor using color code method.

CO2: Understand the basic properties of electrical elements, and solve DC circuit analysis problems, DC network theorems.

CO3: Acquire the knowledge about the characteristics and working principles of PN junction diode, Zener diode, photo diode, LED and different diode applications.

CO4: Understanding and study of rectifier, filter and voltage regulator circuits

Unit -1: Basic Circuit Elements: **(9 Lectures)**

Study of basic circuit elements and passive components: Resistor, Capacitor, Inductor, Transformer, Relays, Switches (working principle, circuit symbols, types, specifications and applications).

Unit -2: Circuit Analysis: **(10 Lectures)**

Concept of Voltage and Current Sources, Internal resistance, Kirchhoff's Current Law, Kirchhoff's Voltage Law, Mesh Analysis, Node Analysis, Principle of Duality, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Millman's Theorem. (Numericals expected)

Unit -3: PN Junction Diode: **(9 Lectures)**

Construction of PN junction, Formation of Depletion Layer, Barrier potential, Forward and Reverse bias, Diode Equation and I-V characteristics, Zener diode, Zener and Avalanche breakdown, Zener diode specifications. Photo diode. Light Emitting Diode (LED): construction and working, 7-segment display and it's applications.

Unit-4: DC Power Supply: **(10 Lectures)**

Need of Power Supply, Block diagram of DC regulated power supply, Rectifiers: Half wave, Full wave rectifiers (center tapped and bridge):- Circuit diagrams, working and waveforms, ripple factor, PIV, efficiency and TUF. Filter-Shunt capacitor filter, Series inductor filter, π - filter. Regulation: Concept of Line and load regulation, Zener diode as voltage regulator, Three pin IC regulators: Block diagram, Specifications and applications. Fixed and Variable voltage IC regulator (IC 78xx,79xx and LM317). Concept of SMPS.

B. Sc. Part – I Semester – I Paper-II
BET24-102: DIGITAL ELECTRONICS-I

Theory: 30 hrs. (38 lectures of 48 minutes)

Marks-50 (**Credits: 02**)

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Understanding the basics of Digital Electronics, different number systems, Binary Codes and signed representation of binary number. Also understand the conversion between different number systems and solve the binary arithmetic problems.

CO2: Design and construction of the basic and universal logic gates and studying the Boolean algebra and simplification of Boolean expression using different methods.

CO3: Understanding and comparing different logic families according IC specifications and their circuit configurations.

CO4: Understand, analyze and design various combinational circuits.

Unit-1: Number System, Codes and Binary Arithmetic: **(10 Lectures)**

Decimal, Binary, Octal and Hexadecimal number systems and their inter conversions. BCD code. ASCII code, Gray Code, Excess-3 Code, Bar code, QR code, Binary Arithmetic: Addition, Subtraction by 1's complement and2's complement method, Representation of signed and unsigned numbers,

Unit-2: Logic Gates, Boolean algebra: **(10 Lectures)**

Study of logic Gates: OR, AND, NOT, NOR, NAND,XOR, XNOR, Universal Gates, Boolean identities and Law's, fundamental theorems of Boolean algebra. Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP).

Arithmetic Circuits: Binary Addition. Half and Full Adder. Half and Full Subtractor, 4-bit binary Adder/Subtractor.

Unit- 3: Logic Families **(10 Lectures)**

Logic Families: Types of Logic Families, Characteristics of Logic Families, TTL NAND gate, TTL NOR gate, TTL NOT gate, Concept of Tristate Logic, MOS Technology, CMOS: NOR, NAND and NOT gates, Comparison of TTL and CMOS logic families.

Unit-4: Combinational circuits: **(8 Lectures)**

Multiplexers: - 2 to 1, 4 to 1 and 8 to 1. Demultiplexers : - 1 to 2, 1 to 4, 1 to 8. Encoder: concept of encoder, Decimal to BCD Encoder. Basic Binary decoders: 2 to 4 line, 3 to 8 line and 4 to 16 line, BCD to decimal decoder, Study of BCD to seven-segment decoder driver IC 7447.

PRACTICAL PAPER – I and II
Credits: 02
Based on BEP24-103
ELECTRONICS LAB
(At least 10 experiments)

1. To familiarize with basic electronic components (R, C, L, diodes, transistors), Digital Multimeter, Function Generator, power supplies and Oscilloscope etc.
2. Measurement of Amplitude, Frequency & Phase difference using Oscilloscope.
3. Verification of Thevenin`s Theorem.
4. Verification of Norton`s Theorem.
5. Verification of Superposition Theorem.
6. Study of the I-V Characteristics of P-N junction Diodes.
7. Study of the a] breakdown Characteristics of Zener Diode
   b] Zener Diode as voltage regulator.
8. Study of Half wave and Full wave rectifier (centre tapped transformer /bridge)
9. Study of Logic Gates.
10. Study of Universal Gates using fundamental gates.
11. Study of De-Morgans Theorems.
12. Study of Half Adder and Full Adder
13. Study of Half Subtractor
14. Study of BCD to seven segment Decoder.
15. Study of Multiplexer (4:1) and Demultiplexer (1:4)

Any 02 from the followings Computer Simulations

1. Study the effect of (a) C- filter and (b) Zener regulator on the output of FWR
2. Verification of the Norton and Thevenin's Theorems.
3. Study any Boolean expression using K-map.

B. Sc. Part – I Semester – II PAPER-III
BET24-201: ANALOG ELECTRONICS-II

Theory: 30 hrs. (38 lectures of 48 minutes)
Marks-50 (**Credits: 02**)

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Analyze output in different operating modes of Bipolar Junction Transistor and Demonstrate the operating principle and output characteristics of Bipolar Junction Transistor

CO2: Explain construction and characteristics of JFETs, MOSFETs and UJT.

CO3: Design biasing circuits for BJT and study different coupling methods used in multistage amplifiers

CO4: Analyze the importance of feedback in amplifiers. Apply the knowledge gained in the design of transistorized circuits and Oscillators.

Unit-1: Bipolar Junction Transistor: **(10 Lectures)**

BJT: Introduction, Structure, Working of transistor. Transistor configurations: CB, CE and CC configurations, characteristics of transistor in CE and CB configurations, Regions of operation (active, cut off and saturation), Current gains α and β. Relations between α and β, dc load line and Q point (Operating point), Significance of Q-point.

Unit-2 Amplifiers: **(10 Lectures)**

Need of transistor Biasing, Transistor biasing and Stabilization circuits- Fixed Bias and Voltage Divider Bias. Thermal runaway, stability and stability factor S., Class A, B, AB and C Amplifiers (Comparative Study on the basis of Q point), Single stage CE amplifier: Current gain, Voltage gain, Power gain, input and output resistances, frequency Response.

Cascaded Amplifiers: Types of coupled amplifier, Two stage RC &DC Coupled Amplifiers and their Frequency Responses. Concept of Differential amplifier and its advantages.

Unit-3: Feedback Amplifier and Oscillators: **(10 Lectures)**

Concept of feedback, negative and positive feedback, advantages of negative feedback (Qualitative only).

Oscillators: Barkhausen criterion for sustained oscillations. Phase shift, Wien Bridge, Hartley and Colpitt's oscillator .

Unit-4: Unipolar Devices: **(8 Lectures)**

JFET: Construction, working and I-V characteristics (output and transfer), MOSFET: Construction, working and I-V characteristics (output and transfer).UJT: introduction, structure and characteristics, UJT as relaxation oscillator.

B. Sc. Part – I Semester – II PAPER-IV
BET24-202: DIGITAL ELECTRONICS-II

Theory: 30 hrs. (38 lectures of 48 minutes)

Marks-50 (**Credits: 02**)

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Understand, analyze and design various sequential circuits.

CO2: Understanding the working of different shift registers and counters.

CO3: Became able to know various types of analog to digital converters and digital to analog converters.

CO4: Understanding of clock and clock circuit, operation of digital circuits with different applications.

Unit-1: Sequential Circuit: **(10 Lectures)**

Concept of Flip-flop, RS, D and JK Flip-Flops, Concept of Clock, Level and Edge Triggered RS,D, JK Flip-flop, Preset and Clear operations. Race-around conditions in JK Flip-Flop, Master- slave JK Flip-Flop, T-Flip-flop

Unit-2: Shift registers and Counters **(10 Lectures)**

Concept of register, Left shift and Right Shift operations, Types of shift registers: SISO, SIPO, PISO & PIPO (only up to 4 bits).

Counters: classification of counters, Asynchronous counters: 3 bit ripple counter, Decade Counter. Synchronous Counter: 3 bit and decade synchronous counter. Ring Counter and Johnson Counter. Applications of Counters.

Unit-3: Data Converters **(9 Lectures)**

4 bit binary weighted and R-2R ladder network DAC: circuit and working. DAC Characteristics: Accuracy and Resolution. ADC: Counter type, successive approximation, Flash ADC, ADC Characteristics .

Unit-4: Applications of Digital Circuit **(9 Lectures)**

Clock generation using logic gate, Study of IC 7495/595, Application of counter (object counter/ digital clock/digital tachometer) Flasher circuit using gates, concept of timer using IC 555 and it's applications.

Semester – II PRACTICAL
Credits 02
Semester- II
BEP24-203
(At least 10 experiments)

1. Study of I-V Characteristics of JFET.
2. Study of Input, Output and transfer Characteristics of CE configuration of BJT
3. Study of Voltage divider bias circuit for CE mode.
4. Design of a Single Stage CE amplifier of given gain
5. Study of the RC Phase Shift Oscillator.
6. Study of the Wien Bridge Oscillator.
7. Study the Colpitt`s oscillator.
8. Study the Hartley oscillator.
9. Building and testing of RS Flip-Flop using NAND/NOR gate.
10. Building and testing D and JK Flip-Flop using IC
11. Construction and study of Shift Register (SISO) using D-type/ JK Flip-Flop ICs
12. Design and study of 4 bit digital to analog converter using R-2R ladder network.
13. Design and study of an Astable Multivibrator using IC 555 Timer.
14. Design and study of a Monostable Multivibrator using IC 555 Timer.

SPICE/MULTISIM simulations for electronic circuits and devices

AT LEAST 02 EXPERIMENTS FROM THE FOLLOWING

Any 02 from the followings computer simulations

1. Design clocked SR and JK Flip-Flops using Gates.
2. Design 4-bit asynchronous counter using Flip-Flop ICs.
3. Design a Counter type ADC