Rayat Shikshan Sanstha's

Yashavantrao Chavan Institute of Science, Satara (Autonomous)

Constituent College of

Karmaveer Bhaurao Patil University, Satara

Re Accredited by NAAC (3rdCycle) with 'A+' grade (CGPA 3.57).

ISO 9001:2015 Certified

Bachelor of Science

Part - I

ELECTRONICS

Syllabus

to be implemented w .e. f. June, 2024 as per NEP 2020

Rayat Shikshan Sanstha's
Yashavantrao Chavan Institute of Science, Satara
Department of Electronics
Syllabus for Bachelor of Science (Electronics)

B.Sc. Electronic

PREAMBLE:

Bachelor of Science is an integrated academic degree in the faculty of Science. The faculty is not ignoring the developments in the field of Electronics. The students from science faculty should also be competent for this change in technology. The Programme will helpful to make students aware of professional ethics of the Industry, prepare them with basic soft skills essential for working in community, professional teams and prepare them for competitive examinations, enabling them to reach higher echelons of excellence and Exploring world with Entrepreneurship approach. The competitive curriculum has prepared at par as per needs of industries and research fields. The topics of the curriculum are well defined, taking into consideration the level and capacity of students. The revision of the existing curriculum of the Electronics subject in science faculty is essential. This is a humble endeavor to initiate the process towards an era of knowledge.

General Objectives of the Program:

1. To nurture academics with a focus commitment to higher subjects.
2. To shape good and informed citizens from the students entering into Programme
3. To create a skilled workforce to match the requirements of the society
4. To impart knowledge of science is the basic objective of this Programme
5. To develop scientific attitude is the major objective so as to make the students open minded, critical and curious.
6. To develop skill in practical work, experiments and laboratory materials and equipments along with the collection and interpretation of scientific data to contribute to science

Program Outcomes:

1.The students will graduate with proficiency in the subject of their choice
2.The students will be eligible to continue higher studies in their subject
3.The students will be eligible to pursue higher studies abroad
4.The students will be eligible to appear for the examinations for job in government organizations and cope up with industry, research fields.
5. The students will be eligible to apply for jobs with minimum requirements of B.Sc. Programme.

Program Specific Objectives

1.To create graduates with sound knowledge of fundamentals of Electronics, who can contribute towards advancing science and technology and make them ready for life- long learning process.
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 as well as prepare students for graduate studies through competitive examinations, enabling them to reach higher echelons of excellence
4.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.

5. 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 the electronic industry.

Program specific Outcomes:

After completing this courses students shall be expert in following things:

1. To prepare students to excel in postgraduate programs or to succeed in industry/technical profession through global and comprehensive education.
2. To provide students with a solid foundation in scientific and quantitative electronics fundamentals required to solve technical problems and also to pursue higher studies.
3. To train students with good technical and scientific breadth so as to comprehend, analyze, design and create novel products and solutions for real life problems.
4. To inculcate in students professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach and an ability to relate Science and engineering issues to broader social context.
5. To prepare student with an academic environment aware of excellence, leadership, written ethical codes and guidelines and the life-long learning needed for a successful professional career.

Programme Outcomes (Subject)

The Undergraduate Students will reveal...

1. Knowledge of differential equations, vector calculus, complex variables, matrix theory, probability theory, physio-chemical study of device properties and network analysis, EM field analysis of electrical and electronics objects.
2. An ability to identify, formulate and solve electrical and electronics problems as well as conduct experiments on electrical and electronics systems, analyze and interpret data.
3. An ability to design electronics systems skills, Critical and analytical thinking skills, Simulating skills, Knowledge on computer hardware and maintenance skills.
4. Skills to use modern industrial tools, software and equipment to analyze and synthesize problems.
5. An ability to visualize and work on laboratory and multidisciplinary tasks.
6. An ability to participate and succeed in competitive examinations and/or seek employment in the industry as well as develop entrepreneurship skills to form a startup.
7. An ability to communicate effectively in both verbal and written form
8. Knowledge of professional and ethical responsibilities.
9. The understanding of the impact of industrial solutions on society and will also be aware of contemporary issues.
10. Confidence for self-education and ability for life-long learning.

Rayat Shikshan Sanstha's
Yashavantrao Chavan Institute of Science, Satara
Department of Electronics
Syllabus for Bachelor of Science (Electronics) Part I

SUBJECT: Electronics

YEAR OF IMPLEMENTATION: New Syllabi for the B.Sc. I Electronics will be implemented from 2022-23 onwards.

1. PREAMBLE:

Bachelor of Science is an integrated academic degree in the faculty of Science. The faculty is not ignoring the developments in the field of Electronics. The students from science faculty should also be competent for this change in technology. The Programme will help to make students aware of professional ethics of the Industry, prepare them with basic soft skills essential for working in community, professional teams and prepare them for competitive examinations, enabling them to reach higher echelons of excellence and explore the world with an Entrepreneurship approach. The competitive curriculum has prepared at par as per needs of industries and research fields. The topics of the curriculum are well defined, taking into consideration the level and capacity of students. The revision of the existing curriculum of the Electronics subject in science faculty is essential. This is a humble endeavor to initiate the process towards an era of knowledge.

2. 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 the ability among students to formulate, analyze and solve real life problems faced in the Electronics industry.
4. To provide opportunity to students to learn the latest trends in Electronics and make them ready for a 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 the electronic industry.

1. Title: Electronics
2. Year of Implementation: The syllabus will be implemented from June, 2024 onwards.
3. Duration: The course shall be a full time.
4. Pattern: Semester examination.
5. Medium of Instruction: English.

B.Sc. Sem - I (Electronics)

Sr. No.	Course Category	Name of Course	Course Code	Credits		Total credits
				TH	PR	
1	DSC -I	Fundamental of Electronics andNetwork Analysis	BET111	2	1	3
2	DSC -II	Digital Electronics-I	BET112	2	1	3
Total				4	2	6

B.Sc. Sem - II (Electronics)

Sr. No.	Course Category	Name of Course	Course Code	Credits		Total credits
				TH	PR	
1	DSC -III	Semiconductor Devices	BET121	2	1	3
2	DSC -IV	Digital Electronics-II	BET122	2	1	3
Total				4	2	6

Abbreviations:
DSC: Discipline Specific Course

Course Structure for B.Sc. I (Semester- I)

Theory				Practical				
Course Title	**Course Code**	**Lecture per week**	**Credits**	**Course**	**Course Title**	**Course Code**	**Lecture per week**	**Credits**
Fundamental of Electronics and Network Analysis	BET111	4	2	Practical -1	Fundamental of Electronics and Network Analysis and Digital Electronics Lab-I	BEP113	4	2
Digital Electronics-I	BET112		2					

Course Structure for B.Sc. I. (Semester- II)

Theory				Practical				
Paper Title	**Paper Code**	**Lecture per week**	**Credits**	**Course**	**Paper Title**	**Paper Code**	**Lecture per week**	**Credits**
Semiconductor Devices	BET121	4	2	Practical-2	Semiconductor Devices and Digital Electronics Lab-II	BEP123	4	2
Digital Electronics-II	BET122		2					

Note: B: B. Sc. T=Theory and P= Practical

Evaluation Structure

Semester - I

Course Name	Course Code	Internal Evaluation			ESE	Total Marks	Credits
		CCE-I	Mid - Semester	CCE-II			
Fundamental of Electronics and Network Analysis	BET 111	5	10	5	30	50	2
Digital Electronics-I	BET 112	5	10	5	30	50	2
Practical Course – I	BEP 113	--	--	--	50	50	2

Semester – II

Course Name	Course	Internal Evaluation			ESE	Total Marks	Credits
		CCE-I	Mid - Semester	CCE-II			
Semiconductor Devices	BET 121	5	10	5	30	50	2
Digital Electronics-II	BET 122	5	10	5	30	50	2
Practical Course – II	BEP 123	--	--	--	50	50	2

Structure and Title of Courses of B. Sc. Course:

B. Sc. I Semester I

Course Number	Course Code	Course Name
I	BET111	Fundamental of Electronics and Network Analysis
II	BET112	Digital Electronics-I
III	BEP113	Fundamental of Electronics, Network Analysis and Digital Electronics Lab- I

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

Course Number	Course Code	Course Name
I	BET121	Semiconductor Devices
II	BET122	Digital Electronics-II
III	BEP123	Semiconductor Devices and Digital Electronics- Lab II

Semester I

Course I: BET111: Fundamental of Electronics and Network Analysis

Course Objectives: Students should be able to …

1. Learn the fundamentals of electronic circuits.
2. Study and verify different and theorems
3. Summarize Two Port Networks.
4. Understand dc and ac circuits

(Total Credits 2)	SEMESTER-I Course: I Fundamental of Electronics and Network Analysis	No. of Lectures per unit
UNIT - I	**Circuit Elements**	**(08)**
	● Introduction, Classification ● Resistors, Capacitor, Inductor: Introduction, Classification, Application's, Color coding, series and parallel Connections, Numerical problems. ● Transformer and Relays: Principle and construction, Types, Applications ● Switches: SPDT, DPDT etc. (Explanation using Symbols) ● Introduction to SMD component.	
UNIT - II	**Network Theorems**	**(07)**
	● Ohm's Law, Kirchhoff's Laws (KCL and KVL), and Numerical problems. ● Theorems: Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Transfer Theorem, Numerical problems based on these network theorems and Numerical problems.	
UNIT - III	**Network Analysis**	**(08)**
	● Two Port Networks: z, y and h parameters and their conversion, Numerical problems ● Star and Delta network, Star to Delta Conversion, and Delta toStar Conversion, Numerical problems,	
UNIT - IV	**Fundamental of AC Circuits**	**(07)**
	● Introduction AC, DC Sources, Voltage and Current Sources, Direction of current and voltage, Comparison AC and DC Sources ● Concept of Power, Instantaneous value , Peak, Peak to Peak, Root Mean Square and Average Values, Phase Difference, ● Voltage-Current Relationship: Resistor, Inductor and Capacitor, Sinusoidal Circuit Analysis for RC circuit. ● Resonance: Series and Parallel RLC Circuits, Frequency Response, Quality (Q) Factor and Bandwidth	

Course Outcome: Students will be able to…

1	Identify active and passive components and understand basic circuit theory
2	Evaluate mesh and nodal analysis of ac and dc circuits.
3	Solve & minimize complex electronic circuits.
4	Design a resonance circuit.

Reference Books:

1. R. S. Sedha, A Textbook of applied electronics, S. Chand Publication, (2003).
2. Sudhkar and S. P. Shyammohan, Circuits and Networks Analysis and Synthesis, Tata McGraw-Hill Publishing Company Limited, 3rd Edition, (2006).
3. B. L. Thereja, Basic Electronics Solid State, S. Chand & Company LTD, 4th Edition,(2004)
4. M. L. Soni & J. C. Gupta, A course in Electrical Circuits Analysis, Delhi Dhanpat Rai & Sons, (1979)
5. Charles K. Alexander, Matthew N. O. Sadiku, Fundamentals of Electric Circuits, McGraw-Hill Education (INDIA) PVT. LTD, (2008)
6. B. L.Thereja, A. K. Thereja, A Textbook of Electrical Technology Volume 1 Basic Electrical Engineering, S. Chand & Company LTD,1st Multicolor Edition, (2005)
7. M. Nahvi and J. Edminister, Theory and Problems of Electric Circuits, Schaum's outline series, McGraw-Hill Book Company,1st Edition, (2005)

Semester I
Course II:
BET112: Digital Electronics-I

Course Objectives: Students should be able to…

1. Learn and verify various number systems.
2. Study logic gates and Boolean algebra.
3. Classify different logic families.
4. Understand the concept of combinational logic circuits.

(Total Credits 2)	**Semester I Course II: Digital Electronics-I**	**No. of Lectures per unit**
UNIT - I	**Number System and Binary Codes**	**(07)**
	● Number System: Introduction, Decimal, Binary, Octal and Hexadecimal number systems, and there interconversion, One's and two's complements, Rules of Binary Addition, Subtraction. Signed and Unsigned numbers, ● Binary Codes: BCD, Excess-3 Code, Gray, ASCII code, Parity Code, Hamming Code.	
UNIT - II	**Logic Gates and Boolean Algebra**	**(07)**
	● Study of Basic Gates, Study of Derived Gates, Universal gates (NOR and NAND),De-Morgan's Theorems ● Boolean algebra and Logic Gates: Introduction to Boolean Algebra and Boolean operators, Standard representation of logic functions (SOP and POS), simplification of logic equation using Boolean algebra. ● Karnaugh map Techniques	
UNIT - III	**Digital Logic Families**	**(08)**
	● Bipolar and MOS Integrated circuits: Characteristics, limitations and applications. ● Analysis of digital logic families: TTL, MOS, CMOSInverters. ● Interfacing between logic families; various logic functionsand their implementation. ● Comparison of CMOS and TTL logic families.	
UNIT - IV	**Combinational Logic Design**	**(08)**
	● Multiplexers: Introduction, 4 to 1, 8 to1, Study of IC 74151/74153,Application ● Demultiplexer: Introduction, 1 to 4, 1 to 8, Study of IC 74139, Application ● Code Convertor: Introduction, Encoder, Decimal to Binary/BCD encoder, Octal to Binary/BCD encoder, Decoder, BCD to 7 Segment decoder, Study of IC 7446/47 Application ● Arithmetic Circuits: Adder, Subtractor, ALU.	

Course Outcomes: The students will be able to…

1	Solve the problems related to interconversion of number system and design
2	Develop logic circuits using logic gates and Boolean algebra.
3	Analyze different logic families.
4	Design combinational logic circuits

Reference Books:

1. M. Morris Mano, Digital System Design, Pearson Education Asia, 4th Edition, (2001)

2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia, 5th Edition, (1994)

3. W. H. Gothmann,Digital Electronics: An Introduction to Theory and Practice, Prentice Hall of India, (2000).

4. S Salivahan, S Arivazhagan, Digital Circuit and Design, Vikas publishing house PVT Limited, (2000)

Semester I

Practical I: BEP 113

Fundamental of Electronics and Digital Electronics Lab-I

Course Objectives: Students should be able to…

1. Identify basic electronics components and circuits.
2. Verify different laws and theorem for solving complex circuit to simplified circuit
3. Simplify the expressions using Boolean algebra and Learn logic gates.
4. Construct sequential and combinational logic circuits.

Total Credits 2	**Semester I Practical I: BEP113 (based on BET111 and BET112) Fundamental of Electronics and Digital Electronics Lab-I**		**No. of Lectures (60)**
	Group A		
	1	Study of Electronics components and tools.	4
	2	Study of Voltage sources in series and parallel	4
	3	Study of Voltage and Current dividers.	4
	4	Study of CRO: Measurement of Amplitude, frequency, and phase difference.	4
	5	To verify Kirchhoff's Voltage and Current law.	4
	6	To study and verification Thevenin's Theorem.	4
	7	To study and verification Superposition Theorem.	4
	8	To study and verification Norton's Theorem.	4
Group B			
	1	To Study Code converters Binary to Gray and Gray to Binary.	4
	2	To Study Logic gates. (IC 7400,7402,7404,7408,7432,7486)	4
	3	To Verify the NAND and NOR gates as universal logic gates.	4
	4	To Study Demorgan's theorem using gates.	4
	5	To Design and verification of the truth tables of Half and Full adder circuits	4
	6	Verification of the truth table of the Multiplexer 74150.	4
	7	Verification of the truth table of the De-Multiplexer 74154.	4
	8	Study of BCD to 7 Segment Decoder.	4

Course Outcome: Students will be able to…

1	Utilize basic electronics components and circuits.
2	Apply the basic theory & mathematical relationships in electronic circuits.
3	Design, construct and verify logic circuits.
4	Develop combinational and sequential logic circuits

Reference Books:

1. R. S. Sedha, Textbook of Applied Electronics, S. Chand Publication, (2003)
2. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley India edition, 2nd Edition, (2002)
3. Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education, 6th Edition, (2006).
4. M. Morris Mano, Digital System Design, Pearson Education Asia, 4th Edition, (2001)
5. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia, 5th Edition, (1994)
6. W. H. Gothmann,Digital Electronics: An Introduction to Theory and Practice, Prentice Hall of India, (2000).
7. S. Salivahan, S Arivazhagan, Digital Circuit and Design, Vikas publishing house PVT Limited, (2000)

Semester II
Course I: BET 121: Semiconductor Devices

Course Objectives: Students should be able to ….

1. Learn the basics of a semiconductor materials
2. Interpret rectifiers and regulators.
3. Understand the basics of transistors and various configurations.
4. Explain the field effect transistor.

(Total Credits 2)	**Semester II** **Course I:** **Semiconductor Devices**	**No. of Lectures per unit**
UNIT - I	**Fundamentals of Semiconductor**	**(08)**
	● Introduction, Types of material, Energy Band diagram, Fermi Level, Types of Semiconductors, Intrinsic & Extrinsic Semiconductors, ● Constructions and working of PN junction diode, Formation of Depletion Layer, I-V characteristics, Applications ● Zener and avalanche breakdown mechanism, Zener diode ● I-V characteristics, Applications ● Photo diode. Light Emitting Diode (LED), 7-segment display, Organic LED. Applications	
UNIT - II	**Unit II: Rectifiers and Regulators**	**(08)**
	● Half wave rectifier, Full wave rectifiers (center tapped and bridge), circuit diagrams, working and waveforms, ripple factor and efficiency. ● Filters: Types, C, L, LC, RC filters (Qualitative analysis) ● Fixed and variable regulators: Zener diode as voltage regulator, IC 78xx and IC 79xx, IC LM 317, Transistor as Regulator	
UNIT - III	**Bipolar Junction Transistors (BJT)**	**(07)**
	● Introduction, Types, Transistor working , CE, CB, CC configurations, Characteristics of CB and CE 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. ● Applications: Transistor as Amplifier, Transistor as a switch.	
UNIT - IV	**Field Effect Transistors**	**(07)**
	● JFET: Type of FET, Symbol, Construction, working and I-V characteristics (output and transfer), Pinch-Off and Saturation Voltage ● MOSFET: Terminals, Symbol, Basic operation, characteristics and MOSFET as switch	

Course Outcome: Students will be able to…

1	Verify and interpret basics of semiconductor materials
2	Inspect rectifiers and regulators.
3	Analyze and interpret the characteristics of transistors
4	Determine characteristics and performance of field effect transistor.

Reference Books:

1. R.S. Sedha, Textbook of Applied Electronics, S. Chand Publication, (2003)
2. Robert Boylestad and Louis Nashelsky, Electronics Devices and Circuits Theory, PHI 9th Edition, (2013)
3. Allen Mottershead, Electronic Devices and Circuits, Goodyear Publishing Corporation, (1973)
4. Donald Neamen, Electronic Circuit Analysis and Design, Tata McGraw Hill, 3rd Edition, (2002)
5. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill, (2001)

Semester II

Course II: BET 122: Digital Electronics-II

Course Objectives: Students should be able to …

1. Learn sequential logic circuits.
2. Study counter circuits.
3. Understand the concept of Shift register and Programmable Logic Device.
4. Explain computer memory organization.

(Total Credits 2)	**Semester II Course IV: Digital Electronics-II**	**No. of Lectures per unit**
UNIT - I	**Sequential Logic Design**	**(07)**
	● Latches and Flip flops, Edge triggered and Level triggered Flip flops, ● S-R Flip flop, J-K Flip flop, J-K Master Slave flip flop, T and D type Flip flop,	
UNIT - II	**Counters**	**(08)**
	● Introduction, Classification, ● Synchronous and Asynchronous Counter, Up/down counter, Decade Counter, Ring Counter, Johnson Counter, Modulo-N Counter, ● Study of IC 7490, Application of counter	
UNIT - III	**Shift Register**	**(07)**
	● Introduction of Shift registers, Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel- in-Parallel-out Shift Registers, ● Study of IC 7495.Applications of Shift Register	
UNIT - IV	**Computer Memory Organization**	**(08)**
	● Introduction, Classification of Memory, Memory Characteristics ● RAM, SRAM, DRAM, ROM, PROM, EPROM, UV-EPROM, EEPROM, FLASH, ● Introduction to cache memory, Memory Hierarchy	

Course Outcomes: The students will be able to…

1 Design sequential logic circuits

2 Develop a counter circuit.

3 Demonstrate shift register circuit.

4 Describe computer memory organization.

Reference Books:

1. M. Morris Mano, Digital System Design, Pearson Education Asia, 4th Edition,(2001)

2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia ,5th Edition,(1994)

3. W. H. Gothmann,Digital Electronics: An Introduction to Theory and Practice, Prentice Hall of India, (2000).

4. S Salivahan, S Arivazhagan, Digital Circuit and Design, Vikas publishing house PVT Limited, (2000)

Semester II
Practical II: BEP 123: (Based on BET121 & BET122)

Semiconductor Devices and Digital Electronics Lab-II

Course Objectives: Students should be able to…

1. Learn half wave and full wave rectifier circuits.
2. Study fixed and variable IC regulators.
3. Understand Flip-flop circuits.
4. Contrast the counter and shift register circuit.

Total Credits 2	**Semester II Practical II: BEP123: (Based on BET121 & BET122) Semiconductor Devices and Digital Electronics Lab-II**		**No. of Lectures (60)**
	Group A		
	1	Study of I-V Characteristics of PN Junction Diode	4
	2	Study of I-V Characteristics of Zener Diode.	4
	3	Transistor as a switch (LED ON/OFF)	4
	4	Study of Three terminal voltage regulators.	4
	5	Study of Half Wave Rectifier with and without capacitor filter.	4
	6	Study of Full Wave Rectifier with and without capacitor filter.	4
	7	Study of input and output I-V Characteristics of BJT in Common Emitter configuration.	4
	8	Study of input and output I-V Characteristics of BJT in Common Base configuration.	4
Group B			
	1	Design and test of an S-R flip-flop using NOR/NAND gates.	4
	2	Verify the truth table of a J-K flip-flop (7476)	4
	3	Verify the truth table of a D flip-flop (7474)	4
	4	Study of Divide by 2/5/10 counter using IC 7490.	4
	5	Study of asynchronous counter. (4-bit / 8 bit)	4
	6	Study of shift register. (4-bit / 8 bit)	4
	7	Study of Ring Counter using IC 7495.	4
	8	Study of computer architecture.	4

Course Outcome: Students will be able to…

1 Design and verify half wave and full wave rectifier circuit.

2 Develop fixed and variable ic regulators.

3 Construct flip flop circuits.

4 Utilize the counter and shift register circuit.

Reference Books:

1. Robert Boylestad and Louis Nashelsky,Electronic Devices and Circuit Theory, PHI,9th Edition, (2013)
2. L. Schilling and C. Belove, Electronic Circuits: Discrete and Integrated, Tata McGraw Hill, (2002).
3. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw Hill,3rdEdition, (2002)
4. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill, (2001)
5. R. C. Jaegar and T. N. Blalock, Microelectronic Circuit Design, Tata McGraw Hill 4th Edition, (2010)
6. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, TataMcGraw Hill, (1991)