Electronics Syllabus

MODEL CURRICULUM

ELECTRONICS

B.Sc. Courses (Structure)

First year:

S.no.	Subject	Hrs per week
1.	English language including communication skills	6
2.	Second language	4
3.	Core1-I	4
4.	Core2-I	4
5.	Core3-I	4
6.	Core1-lab I	3
7.	Core2-lab I	3
8.	Core3-lab I	3
9.	Foundation course	3
10.	Computer skills	2
	Total	**36**

Second year:

S.no.	Subject	Hrs per week
1.	English language including communication skills	6
2.	Second language	4
3.	Core1-II	4
4.	Core2-II	4
5.	Core3-II	4
6.	Core1-lab II	3
7.	Core2-lab II	3
8.	Core3-lab II	3
9.	Environmental studies	4
10.	Computer skills	2
	Total	**37**

Third year:

S.no.	Subject	Hrs per week
1.	Core1-III	3
2.	Core1-IV	3
3.	Core2-III	3
4.	Core2-IV	3
5.	Core3-III	3
6.	Core3-IV	3
7.	Core1-lab III	3
8.	Core1-lab IV	3
9.	Core2-lab III	3
10.	Core2-lab IV	3
11.	Core3-lab III	3
12.	Core3-lab IV	3
13.	Foundation course	3
	Total	**39**

B.Sc (Electronics) – Scheme of instruction

S.No.	Year	Paper	Hours/week	Total hours
		A. THEORY		
01	First Year	**Paper-I** Circuit Analysis and Electronic Devices	4hrs/ Week	120 Hours
02	Second Year	**Paper-II** Analog Circuits and Communications	4hrs/ Week	120 Hours
03	Third Year	**Paper –III** Digital Electronics and Microprocessor.	3hrs/ Week	90 Hours
04	Third Year	**Paper –IV (Electives)** ***Any one of the following*** **i) Paper – IVA** Embedded Systems and Applications **ii) Paper – IVB** Digital Design using VHDL	3hrs/ Week	90 Hours
		B. PRACTICALS		
05	First Year	**Paper – I:** Circuit Analysis and Electronic Devices Lab	3hrs/Week	90 Hours (30Sessions)
06	Second Year	**Paper – II:** Analog Circuits and Communication Lab	3hrs/ Week	90 Hours (30Sessions)
07	Third Year	**Paper – III:** Digital Electronics and Microprocessor Lab	3hrs/ Week	90 Hours (30 Sessions)
08	Third Year	**Paper – IV (Electives)** **Any one of the following** **Paper - IV (A):** Embedded Systems and Applications Lab **Paper - IV (B):** Digital design Using VHDL Lab	3 hrs/Week	90 Hours (30 Sessions)

B.Sc I Year -Electronics

PAPER-I Circuit Analysis and Electronic Devices. (120 hours)

UNIT-I (30 hours)

***AC Fundamentals*:** The Sine wave –Average and RMS values–The J operator – Polar and rectangular forms of complex numbers – Phasor diagram – Complex impedance and admittance.

Passive networks: Concept of voltage and current sources – KVL and KCL- Application to simple circuits (AC and DC) consisting of resistors and sources (one or two) - Node voltage analysis and method of mesh currents.

Network theorems (DC and AC): Superposition Theorem–Thevenin's Theorem– Norton's Theorem–Maximum power transfer Theorem–Millman Theorem- Reciprocity Theorem – Application to simple networks.

UNIT- II (30 hours)

***RC and RL Circuits*:** Transient response of RL and RC circuits with step input– time constants. Frequency response of RC and RL circuits – Types of Filters: Low pass filter – High pass filter – frequency response - Passive differentiating and integrating circuits.

***Resonance*:** Series resonance and parallel resonance RLC circuits – Resonant frequency – Q factor – Band width – Selectivity.

UNIT-III (30 hours)

PN Junction: Depletion region – Junction capacitance – Diode equation (no derivation) – Effect of temperature on reverse saturation current – construction, working, V-I characteristics and simple applications of
i) Junction diode ii) Zener diode iii) Tunnel diode and iv) Varactor diode.

Bipolar Junction Transistor (BJT): PNP and NPN transistors–current components in BJT – BJT static characteristics (Input and Output) – Early effect- CB, CC,CE configurations (cut off, active, and saturation regions) CE configuration as two port network – h-parameters – h-parameter equivalent circuit. Experimental arrangement to study input and output characteristics of BJT in CE configuration. Determination of h-parameters from the characteristics. Biasing and load line analysis – Fixed bias and self bias arrangement.

UNIT-IV (30 hours)

Field Effect Transistor (FET): Structure and working of JFET and MOSFET – output and transfer characteristics – Experimental arrangement for studying the characteristics and to determine FET parameters. Application of FET as voltage variable resistor and MOSFET as a switch – Advantages of FET over transistor.

Uni Junction Transistor (UJT): Structure and working of UJT- Characteristics. Application of UJT as a relaxation oscillator.

Silicon Controlled Rectifier (SCR): Structure and working of SCR. Two transistor representation, Characteristics of SCR. Experimental set up to study the SCR characteristics. Application of SCR for power control.

Photo Electric Devices: Structure and operation of LDR, Photo voltaic cell, Photo diode, Photo transistors and LED.

(**NOTE:** ***Solving related problems in all the Units***)

Reference Books:

1. Grob's Basic Electronics - Mitchel E.Schultz 10^{th} Edn. Tata McGraw Hill (TMH)
2. Network lines and fields- Ryder- Prentice Hall of India (PHI)
3. Circuit analysis - P.Gnanasivam- Pearson Education
4. Circuits and Networks - A.Sudhaksr & Shyammohan S. Palli - TMH
5. Network Theory - Smarajit Ghosh - PHI
6. Electronic Devices and Circuits-Millman and Halkias - TMH
7. Electronic Devices and Circuits-Allen Mottershead - PHI
8. Principles of Electronics- V.K. Mehta and Rohit Mehta - S Chand &Co
9. Electronic Devices and Circuit Theory- R.L.Boylestad and L.Nashelsky- Pearson Education.
10. Pulse digital switching waveforms -Millman &Taub - TMH.
11. Applied Electronics- R.S.Sedha - S Chand &Co
12. A First course in Electronics- AA Khan & KK Day- PHI
13. Principles of Electronic circuits- Stanely G.Burns and Paul R. Bond- Galgotia.
14. Electronic Principles and Applications – A.B. Bhattacharya- New Central Book Agency Pvt.

B.Sc I Year - Electronics

PRACTICALS PAPER-I (90 hours-30 Sessions)

Circuit Analysis and Electronic devices Lab

1. Measurement of peak voltage, frequency and phase using CRO.
2. Thevenin's theorem – verification.
3. Norton's theorem – verification.
4. Maximum power transfer theorem – verification.
5. CR and LRcircuits- Frequency response- (Low pass and High pass).
6. CR and LR circuits - Differentiation and integration - tracing of waveforms.
7. LCR–Series resonance circuit–Frequency response–Determination of f_o, Q and band width.
8. To draw volt-ampere characteristics of Junction diode and determine the cut-in voltage, forward and reverse resistances.
9. Zener diode V-I Characteristics– Determination of Zener breakdown voltage.
10. Voltage regulator using Zener diode
11. BJT input and output characteristics (CE configuration) and determination of 'h' parameters.
12. FET –Characteristics and determination of FET parameters.
13. UJT as relaxation oscillator.
14. LDR- characteristics.
15. SCR Volt-ampere characteristics.

Note: Student has to perform any 12 experiments.

B.Sc II Year- Electronics

PAPER–II Analog Circuits and Communications (120 hours)

UNIT- I (30 hours)

Power Supplies: Rectifiers– Halfwave, fullwave and bridge rectifiers- Efficiency- Ripple factor- Regulation – Harmonic components in rectified output – Types of filters- Choke input (inductor) filter- Shunt capacitor filter- L section and π section filters – Block diagram of regulated power supply - Series and shunt regulated power supplies – Three terminal regulators (78XX and 79XX) – Principle and working of switch mode power supply (SMPS).

UNIT-II (30 hours)

RC Coupled Amplifier: Analysis and frequency response of single stage RC coupled CE amplifier.

Feedback: Positive and negative feedback- Effect of feedback on gain, band width, noise, input and output impedances.

Operational Amplifiers: Differential amplifier- Block diagram of Op-Amp- Ideal characteristics of Op-Amp- Op-Amp parameters- Input resistance- Output resistance- Common mode rejection ratio (CMMR)- Slew rate- Offset voltages – Input bias current- Basic Op-Amp circuits- Inverting Op-Amp- Virtual ground- Non-inverting Op-Amp- Frequency response of Op-Amp. Interpretation of Op-Amp data sheets.

UNIT-III (30 hours)

Applications of Op-Amps: Summing amplifier- subtractor- Voltage follower- Integrator- Differentiator - Comparator- Logarithmic amplifier- Sine wave [Wein Bridge] and square wave [Astable] generators- Triangular wave generator- Monostable multivibrator- Solving simple second order differential equation. Basic Op-Amp series regulator and shunt regulator.

UNIT-IV (30 hours)

Communications: Need for modulation-Types of modulation- Amplitude, Frequency and Phase modulation.
Amplitude modulation-side bands- modulation index- square law diode modulator- Demodulation- diode detector.

Frequency modulation working of simple frequency modulator- Ratio detection of FM waves- Advantages of frequency modulation.
AM and FM radio receivers [block diagram approach].

(**NOTE:** ***Solving related problems in all the Units***)

Reference Books:

1. Electronic Devices and Circuits-Millman and Halkias- Tata Mc Graw Hill (TMH)
2. Microelectronics- J. Millman and A. Grabel - TMH
3. Operational Amplifiers and Linear Integrated Circuits- Ramakant A. Gayakwad- Prentice Hall of India (PHI).
4. Operational Amplifiers and Linear Integrated Circuits- K. Lalkishore - Pearson Education
5. Analog Electronics- L.K. Maheswari and M.M.S. Anand- PHI
6. Applied Electronics- R.S.Sedha- S Chand &Co
7. Principles of Electronics- V.K. Mehta and Rohit Mehta - S Chand &Co
8. A first Course in Electronics – A.A.Khan & K.K. Dey - PHI
9. Electronic Communication Systems - George Kennedy & Bernard Davis - TMH.
10. Electronic Communication -D. Roddy & J. Coolen- PHI
11. Principles of Electronic Communication Systems –Louis E. Frenzel -TMH

B.Sc II Year - Electronics

PRACTICALS PAPER-II (90 hours - 30 Sessions)

Analog Circuits and Communications Lab

1. D.C Power supply and filters.
2. Single stage RC – coupled amplifier – frequency response.
3. OP-Amp (IC 741) as
   a) Inverting amplifier.
   b) Non- inverting amplifier.
   c) Comparator.
4. OP-Amp (IC 741) as
   a) Integrator.
   b) Differentiator.
5. OP-Amp as Wien bridge oscillator.

6. Astable multivibrator – Determination of frequency (using IC741 Op-Amp).

7. Monostable multivibrator–Determination of pulse width (using IC 741Op Amp).

8. Voltage regulator using IC- 7805and IC-7905.

9. AM modulator and Demodulator.

10. FM modulator.

11. Simulation experiments using appropriate electronic circuit simulation software.

    a) RC coupled amplifier.
    b) Wien bridge oscillator.
    c) Astable multivibrator.
    d) Amplitude Modulation.
    e) Frequency Modulation.

Note: Student has to perform the following experiments

(1) Any 7 experiments among the experiment numbers1to10.

(2) Experiment Number 11 (a,b,c,d and e) is compulsory

STUDENTS ARE ENCOURAGED TO DO A SMALL PROJECT WORK DURING SECOND YEAR

B.Sc III Year - Electronics

PAPER – III Digital Electronics and Microprocessor (90 hours)

UNIT-I (23 HOURS)

Introduction to number systems, Logic gates OR, AND, NOT, X-OR, NAND, NOR gates - Truth tables – Positive and negative logic – Logic families and their characteristics – RTL, DTL, ECL, TTL and CMOS.– Universal building blocks NAND and NOR gates. Laws of Boolean algebra De Morgan's Theorems – Boolean identities – Simplification of Boolean expressions– Karnaugh Maps – Sum of products (SOP) and Product of sums (POS).

UNIT-II (22 HOURS)

Combinational and Sequential circuits: Multiplexer and De-Multiplexer – Decoder, Half adder, Full adder and Parallel adder circuits. Flip flops – RS, D, JK and JK Master-Slave (working and truth tables) - Semiconductor memories – Organization and working- Synchronous and asynchronous binary counters, Up/Down counters- Decade counter (7490) - working, truth tables and timing diagrams.

UNIT-III (23 HOURS)

Introduction to Microcomputer and Microprocessor: Intel 8085 Microprocessor – central processing unit CPU – arithmetic and logic unit ALU – timing and control unit – register organization – address, data and control buses- pin configuration of 8085 and its description. Timing diagrams- Instruction cycle, machine cycle, fetch and execute cycles.

Instruction set of 8085, instruction and data formats- classification of instructions – addressing modes. Assembly language programming examples of 8 and 16 bit addition, subtraction, multiplication and division. Finding the largest and smallest in a data array. Programming examples using stacks and subroutines.

UNIT-IV (22 HOURS)

Interfacing peripherals and applications: Programmable peripheral interface (8255) - D/A and A/D converters and their interfacing to the Microprocessor. Stepper motor control- seven segment LED.

(**NOTE:** ***Solving related problems in all the Units***)

Reference Books:

1. Digital Principles and Applications- Malvino & Leach- TMH
2. Digital Fundamentals – F.Loyd & Jain- Pearson Education
3. Modern Digital Electronics- R.P Jain-TMH
4. Fundamentals of Digital Circuits- Anand Kumar- PHI
5. Digital Systems – Rajkamal- Pearson Education
6. Digital Electronic Principles and Integrated Circuits- Maini- Willey India
7. Digital Electronics- Gothman-
8. Digital Electronics –J.W. Bignel & Robert Donova- Thomson Publishers (Indian 5th Ed)
9. Microprocessor Architecture and Programming – Ramesh S. Goanker- Penram
10. Introduction to Microprocessor – Aditya. P. Mathur- TMH
11. Microprocessors and Microcontrollers Hardware and Interfacing- Mathivannan- PHI
12. Fundamentals of Microprocessors and Microcontrollers – B. Ram-Dhanpat Rai & Sons.
13. Advanced Microprocessor and Peripherals, Architecture, Programming and Interface- A.K.Ray and K.N. Bhurchandi- TMH
14. Microprocessor Lab Premier- K.A. Krishna Murthy

B.Sc III Year - Electronics

PRACTICAL PAPER-III (90 hours – 30 sessions)

Digital Electronics and Microprocessor Lab

A) Digital Experiments

1. Verification of truth tables of OR, AND, NOT, NAND, NOR, EX-OR gates (By using 7400-series)
2. Construction of gates using NAND, NOR gates.
3. Construction of Half and Full adders and verifying their truth tables.
4. Operation and verifying truth tables of flip- flops- RS, D, and JK using ICs.
5. Construction of Decade counters (7490).
6. Driving Stepper motor using JK flip-flop
7. Simulation experiments using appropriate electronic circuit simulation.
   a) 4-bit parallel adder using combinational circuits.
   b) Decade counter using JK flip flops.
   c) Up/Down counter using JK flip flop.
   d) Up/Down counter using 7493.

B) MICROPROCESSOR (Software)

1. Binary addition & subtraction. (8-bit & 16-bit)
2. Multiplication & division.
3. Picking up largest/smallest number.
4. Arranging –ascending/descending order.
5. Decimal addition (DAA) & Subtraction.
6. Time delay generation

C) MICROPROCESSOR (Hardware)

1. Interfacing R-2R Ladder network (DAC) (4 bits) to generate waveforms.
2. Interfacing a stepper motor and rotating it clockwise/anti clockwise through a known angle.
3. Interfacing a seven segment display.
4. Interfacing ADC for temperature measurement.

Note: Student has to perform the following experiments:

(i) In Section (A) any four experiments among experiment numbers 1to 6
(ii) Experiment Number 7 (a, b, c and d) is compulsory
(iii) All experiments in section (B)
(iv) Any two experiments in section (C).

STUDENTS ARE ENCOURAGED TO DO A SMALL PROJECT WORK DURING THIRD YEAR

B.Sc III Year –Electronics
Elective Paper–IV(A): Embedded Systems and Applications (90 hours)

Unit– I (22 Hours)

The 8051 Microcontroller

Introduction to microcontrollers and embedded systems: Overview and block diagram of 8051. Architecture of 8051. Program counter and memory organisation. Data types and directives, Flag bits and PSW Register, Register banks and Stack; Pin diagram, Port organisation, I/O Programming, Bit manipulation. Interrupts and timer.

Unit–II (23 Hours)

Addressing modes, instruction set and assembly language programming of 8051
Addressing modes and accessing memory using various addressing modes. Instruction set: Arithmetic, Logical, Single Bit, Jump, Loop and Call Instructions and their usage. Time Delay Generation and Calculation; Timer/Counter Programming. Programming examples: Addition, multiplication, subtraction, division, arranging a given set of numbers in ascending / descending order, picking the smallest / largest number among a given set of numbers, Accessing a specified port terminal and generating a rectangular waveform.

Unit – III (22 Hours)
Interfacing of peripherals to Microcontroller

Interfacing of - PPI 8255, DAC, ADC. Serial communication- modes and protocols

Unit – IV (23 Hours)
Applications of Embedded Systems

Temperature measurement, displaying information on a LCD, Control of a Stepper Motor, Interfacing a keyboard and generation different types of waveforms.

Reference Books:

1. The 8051 Microcontrollers and Embedded Systems – By Muhammad Ali Mazidi and Janice Gillispie Mazidi- Pearson Education Asia, 4th Reprint, 2002
2. Microcontrollers – Theory and applications by Ajay V. Deshmukh-Tata McGraw-Hill
3. The 8051 Microcontroller - architecture, programming & applications By Kenneth J. Ayala- Penram International Publishing, 1995

4. Programming and Customizing the 8051 Microcontroller – By Myke Predko- TMH, 2003

5. Design with Microcontrollers By - J B Peatman- TMH.

6. The 8051 Microcontroller - Programming, interfacing and applications by Howard Boyet and Ron Katz - (MII) Microprocessors Training Inc.

7. The concepts & features of Microcontrollers by Rajkamal - Wheeler Pub.

B.Sc III Year –Electronics

Elective Paper – IV (A): PRACTICALS (90 Hours- 30 Sessions)

Embedded Systems and Applications Lab

Microcontroller Experiments using 8051 kit

1. Multiplication of two numbers using MUL command (later using counter method for repeated addition)
2. Division of two numbers using DIV command (later using counter method for repeated subtraction)
3. Pick the smallest number among a given set of numbers
4. Pick the largest number among a given set of numbers
5. Arrange 'n' numbers in ascending order
6. Arrange 'n' numbers in descending order
7. Generate a specified time delay
8. Interface a ADC and a temperature sensor to measure temperature
9. Interface a DAC & Generate a stair case wave form – with step duration and no. of steps as variables
10. Flash a LED connected at a specified out put port terminal
11. Interface a stepper motor – and rotate it clock wise or anti clock wise through given angle steps
12. Using Keil software write a program to pick the smallest among a given set of numbers
13. Using Keil software write a program to pick the largest among a given set of numbers
14. Using Keil software write a program to arrange a given set of numbers in ascending order
15. Using Keil software write a program to arrange a given set of numbers in descending order
16. Using Keil software write a program to generate a rectangular wave form at a specified port terminal

Note: Student has to perform the following experiments

(1) 8 Experiments among experiment numbers 1 to 11

(2) Experiment Numbers from 12 to16 are compulsory

STUDENTS ARE ENCOURAGED TO DO A SMALL PROJECT WORK DURING THIRD YEAR

B.Sc III Year –Electronics

Elective Paper – IV (B) : Digital Design Using VHDL (90 Hours)

UNIT – I (22 Hours)

Introduction & Behavioural Modeling

Introduction to HDLs: Difference between HDL and other software languages – Different HDLs in vogue. Overview of digital system design using HDL

Basic VHDL Language Elements: Identifiers, Data objects, scalar and composite data types, Operators

Behavioural Modeling with examples: Entity declaration, Architecture body, Process statement and sequential statements. Inertial and transport delay models, creating signal waveforms, signal drivers, effect of transport and inertial delays on signal drivers.

UNIT – II (23 Hours)

Data Flow and Structural Modeling

Data Flow Modeling with examples: Concurrent signal assignment statement, Concurrent versus sequential signal assignment, Delta delays, Multiple drivers, Conditional signal assignment statement, selected signal assignment statement, concurrent assertion statement.

Structural Modeling with examples: Component declaration, Component instantiation and examples**,** Direct instantiation of component.

UNIT – III (23 Hours)

Subprograms and Packages

Subprograms and Overloading: Functions and procedures with simple examples - subprogram overloading, Operator overloading.

Packages and Libraries: Package declaration, package body, design file, design libraries, order of analysis, implicit visibility, explicit visibility, library clause and use clause.

Advanced Features: Entity statements, Generate statements, Attributes, Aggregate targets, ports and their behaviour.

UNIT – IV (22 Hours)

Simulation and Hardware modeling

Model Simulation: Simulation – Writing a Test Bench for a Half and a Full adder.

Hardware Modeling Examples: Modeling entity interfaces, Modeling simple elements, Different styles of modeling, Modeling regular structures, Modeling delays, Modeling conditional operations, Modeling a clock divider and a pulse counter.

Reference Books

1. A VHDL Primer - By J.Bhasker ., 3rd edition - PHI, New Delhi, 2007
2. Circuit design with VHDL by Volnei . Pedroni – PHI, New Delhi, 2007
3. Digital Systems Design using VHDL by Charles H.Roth Jr.- PWS Pub.,1998
4. Introductory VHDL : From Simulation to Synthesis – by Sudhakar Yalamanchili.- Pearson Education Asia., 2001
5. VHDL Programming by Example – By Douglas L.Perry.- 4th Ed - TMH., 2002
6. Fundamentals of Digital Logic with VHDL Design – by Stephen Brown & Zvonko Vranesic - TMH. 2002
7. VHDL – Analysis & Modeling of Digital Systems – By Zainalabedin Navabi- 2nd Ed - TMH, 1998
8. The Designer's Guide to VHDL - By Peter J. Ashenden -2nd Ed., 1st Indian Reprint- Harcourt India Pvt. Ltd., 2001.

B.Sc III Year –Electronics

Elective Paper – IV (B): PRACTICALS (*90 Hours- 30 Sessions*)

Digital design Using VHDL Lab

VHDL –Program entry, simulation & implementation (CPLD/ FPGA) using appropriate HDL Software for the following circuits.

1. All types of logic gates (Data Flow)
2. Half adder (Data flow, Structural and Schematic)
3. Full adder (Data flow, Structural and Schematic)
4. Half subtractor (Data flow, Structural and Schematic)

5. Full subtractor (Data flow, Structural and Schematic)
6. Two control input Mux – using case
7. Two control input Mux – using conditional signal assignment
8. Two control input Mux – using selected signal assignment
9. Two control input Dmux - using case
10. BCD to seven segment decoder (schematic)
11. Modeling a RS-FF with assertion, report & different levels of severity (Behavioural)
12. Modeling a BCD Counter (Top level behavioural)
13. Writing a Test Bench for a Half adder
14. Writing a Test bench for Full Adder

Note: Student has to perform any 12 experiments

STUDENTS ARE ENCOURAGED TO DO A SMALL PROJECT WORK DURING THIRD YEAR