F.Y. B. Sc. Electronic Science

Paper I: Principles of Analog Electronics

Unit 1: Passive components   (10)
Circuit symbols, working principle, classification according to construction, specifications, and applications of passive components - resistor, capacitor, inductor, transformer, switches, fuses, cables, connectors, batteries, relays and PCBs.

Unit 2: Basic Circuits Using passive components   (14)
Concept of Ideal Voltage and Current source, internal resistance, ac and dc source, Ohms Law, potential divider arrangement, Different type of Signals in electronics, Step response of RC circuit, RC time constant, RC circuit with square wave input. Low pass, high pass and band pass filters using RLC circuits, Concept of reactance and impedance, Qualitative idea of resonance. Concept of phasor(using complex algebra) addition of voltage and current in phasor form, Impedance determination using phasor, phasor treatment for passive filter.

Unit 3: Network Theorems   (10)
Kirchhoff's current and voltage law, Application of KVL& KCL to simple dc resistive networks. T and Π networks and their interconversion. Mesh current and loop current method of circuit analysis. Thevenin and Norton theorems and corresponding equivalent of simple resistive networks. Superposition theorem, Maximum power transfer theorem.

Unit 4: Semiconductor devices   (18)
Circuit Symbol, construction, working principle, specifications, parameters, I-V characteristics, types and applications of rectifier pn junction diode, switching diode, varactor diode, Zener diode, LED, photo diode, optocoupler, BJT, UJT, JFET, MOS Capacitor, MOSFET, MESFET, SCR, DIAC and TRIAC.

Unit 5: Basic Circuits using Active Devices   (16)
Diode circuits - Rectifiers, voltage doublers, clipping and clamping circuits, Zener regulator,
BJT circuits – basic amplifier, Potential divider biasing of BJT, comparative study of CE, CB, CC configurations, transistor as a switch and inverter, current mirror using BJT.
UJT circuits - Relaxation Oscillator using UJT.
FET circuits - FET as Voltage Variable Resistor, FET amplifier, comparative study of CD,CG, CS configurations, current source using JFET/MOSFET

Unit 6: Operational amplifier.   (4)
Idea of operational amplifier (OPAMP), Ideal OPAMP as black box, input and output impedance, Opamp circuits as buffer, inverting and non inverting amplifiers, adder and subtractor.

Reference Books –(Latest edition of)
1. B. L . Theraja . " A text book of electrical technology ", S.Chand and Co.
2. V.K. Mehta ,"Principals of Electronics " , S.Chand and Co.
3. Malvino ," Electronics Principles",Tata McGraw Hill
4. Motorshed A , "Electronic Devices and circuits ", Prentice Hall of India
5. Bolyestad ,"Electronic Devices and Circuits ", Tata McGraw Hill
6. Madhuri Joshi , Electronic Components and Materials " , A.H. Wheeler and Co.
7. S.Salivahanan , N,Sureshkumar , A.Vallavaraj ,"Semiconductor devices and circuits TMH(2002)"

Paper II Principles of Digital Electronics

Unit 1: Number systems (5)
Decimal, Binary, Octal and hexadecimal number systems and their interconversions, signed and fractional binary number representations, BCD, Excess-3 and Gray codes, alphanumeric representation in ASCII codes.

Unit 2: Logic Gates (5)
Positive and Negative Logic, Basic Logic gates & derived gates Symbol and truth table, circuit diagram for basic gates using switches, diodes and transistors, Applications of Ex-OR gates as parity checker and generator.

Unit 3: Boolean algebra (8)
Boolean axioms. Min terms, Max terms , Boolean expression in SOP form and POS form , conversion of SOP/POS expression to its standard SOP/POS form.DeMorgen's theorem, universal gates, Simplifications of Logic equations using laws of Boolean algebra and / or Karnaugh map (up to 4 variables).

Unit 4: Arithmetic Circuits (8)
Rules of binary addition, subtraction, subtraction using 1's and 2's complements, half adder, full adder, parallel adder, universal adder / subtractor, comparator.

Unit 5: Combinational Circuits (10)
Multiplexer & demultiplexer (max. 4 input or output)
Encoder & decoder, code converters - Decimal to binary, Binary to BCD, Hex to binary, BCD to seven segment decoder, 3x4 matrix keyboard encoder.

Unit 6: Sequential circuits (18)
Flip Flops - RS Flip flop using NAND/NOR gates, clocked RS, JK Flip flop, Master slave JK, D Flip flop, T Flip flop.
Counters – Ripple Binary counter, up down counter, concept of modulus counters, Decade counter, Counters for high-speed applications (Synchronous counters) with timing diagrams. Introduction to finite state machine.
Shift registers – SISO, SIPO, PISO, PIPO shift registers, ring counter,   universal 4 bit shift register, applications

Unit 7: Logic families (10)
Digital Integrated Circuits, Integrated circuit technologies TTL, ECL, CMOS. Logic levels, switching speed, propagation delay, power dissipation, noise margins and fanout of TTL and CMOS. TTL NAND & NOT gate, Open collector gates, Wired OR operation. CMOS NOT, NAND, NOR gate, precautions while handling CMOS gates, Compatibility and interconnection of TTL and CMOS devices.

Unit 8: Semiconductor Memories (8)
Units of Binary data storage, Semiconductor memory cell (MOSFET based) and array, Memory address and capacity, RAM Static & Dynamic, ROM, EPROM, EEPROM.

Reference Books :

1. Malvino Leach , "Digital Principles & Applications",(IV Edition) McGraw Hill
2. T.M. Floyd R.P. Jain, "Digital fundamentals", Pearson Education
3. R.P.Jain, "Digital Electronics", Tata McGraw Hill
4. John P. Uyemura ,"First course in Digital System Design ", Brooks/Cole,Thompson Learning (2001)
5. Agrawal "Digital electronics " Himalaya publishing

List of Electronics Practicals for FYBSc

Paper III Practicals

1. **The practical course consists of 20 experiments.**
2. **Any two of the following activities with proper documentation will be considered as equivalent of 4 experiments weightage in term work. These will be evaluated in an oral examination for 20% marks at internal and term end examination.**

   i. preparatory experiments
   ii. hobby projects
   iii. Internet Searching
   iv. industrial visit / live work experience

3. **All the students are required to complete a minimum of 16 experiments (four from each group) from the following list.**

   Group A Any Four
   1. Study of forward and Reverse biased characteristics of PN Junction Diode
   2. Study of breakdown characteristics and voltage regulation action of Zener diode
   3. Study of output characteristics of Bipolar Junction Transistor in CE mode
   4. Study of output and transfer characteristics JFET/MOSFET
   5. Study of I-V characteristics of UJT and UJT based relaxation oscillator   .
   6. Study of I-V characteristics of SCR

   Group B Any four
   . 1. Verification of network theorems
          KCL / KVL, Thevenin, Norton, Maximum Power Transfer, Superposition theorem
   2. Design, build and test Low pass and High pass RC filters
   3. Study of low voltage Half-wave , Full-wave and Bridge rectifier circuits
   4. Study of switching and amplification actions of BJT and JFET/MOSFET
   5. Study of potential divider biasing of BJT and its use in DC motor driving
   6. Build and test Inverting and noninverting amplifier using OPAMP.
   7. Build and test adder and subtractor circuits using OPAMP.

   Group C Any Four
   1. Basic Logic gates using Diodes and transistors
   2. Interconversion of logic expression , develop a circuit using ICs
   3. Study of RS, JK and D flip flops using NAND gates
   4. Study of Up/Down Counter
   5. Study of decade counter IC circuit configurations
   6. Study of 4-bit Shift register IC

   Group D Any Four
   1. Build and Test 4 bit parity checker/ generator using X-OR gate IC
   2. Build and Test Half Adder, Full Adder and Subtractor using basic gate
   3. Build and Test 2:1 Multiplexer / 1:2 Demultiplexer using gates
   4. Build and Test 3X4 matrix Keyboard Encoder
   5. Build and Test a Debounce switch using NAND or NOR gate IC
   6. Build and Test Diode matrix ROM

Preparatory experiments

1. Identification of components / Tools
    - Minimum 10 different types of components must be given
    - Identification based on visual inspection / data sheets be carried out
2. Use of Multimeters (Analog and Digital)
    - Measurement of AC/DC voltage and Current – on different ranges
    - Measurement of R & C
    - Testing of Diodes & Transistors
    - Measurement of h_{fe}
    - Use of Multimeter in measurement of Variation of Resistance of LDR? Thermister (graph expected)
3. Study of Signal Generator/CRO
    - Understand how to use Signal Generator/CRO
    - Study of Front panel controls
    - Measurement of amplitude and frequency on Sine/Square waveform
    - Measurement of Phase with the help of RC circuit
    - Demonstration of Lissajous figures
    - Demonstrate the use of Component Facility

Hobby project Examples

Build and Test gadgets like
- Water level Indicator
- Photo relay / smoke detector
- Burglar Alarm
- Fan   regulator
- Logic Probe