

Center for Electronics
Ewing Christian College, Prayagraj
(An Autonomous Constituent College of University of Allahabad)
Syllabus of B.Sc. (Electronics) for Semester System

Semester - I

Paper I –Analog Electronics I

Unit 1- Semiconductor Basics and Diodes:

Resistance – Ohm’s Law, Color code, Tolerance, Standard values of commonly available resistance E_6 , E_{12} and E , Properties and Energy Band description of Solid, Valance Band and Conduction band, semiconductors types, Effect of temperature on semiconductor, Law of mass action, Law of neutrality, Drift and Diffusion current, Conductivity, Resistivity, mobility. PN junction diode, Depletion layer, Potential barrier, Knee voltage, Breakdown voltage, PIV, Diode equation (Shockley Equation) and V/I characteristic, Zener and Avalanche breakdown mechanism, Storage and Transition capacitances, Zener diode, Varactor diode, Tunnel diode, Photo diode, LED, Half wave rectifier, Full wave Rectifiers and Filters, Clippers and Clampers.

Unit 2- Network Theorems:

Definition of Active and Passive components, Kirchhoff’s Current and Voltage laws, DC and AC Sources, Maximum Power Transfer Theorem, Thevenin’s Theorem, Norton’s Theorem, Superposition Theorem and Reciprocity Theorem

Unit 3- Bipolar Junction Transistors (BJT):

Construction and working of npn and pnp transistors, CB, CE and CC configurations, I/O characteristics of transistor, Current gains and their relationship, Different regions of operation (Active, cut off, saturation and inverted), leakage current, Transistor DC load line analysis, Operating point, Thermal Run away, Transistor biasing, Transistor stabilization, Stabilization factor, Different biasing circuits, h-parameters, Photo transistor.

Unit 4- Field Effect Transistors (FET):

Types of FET, Construction, Principle and working of JFET and MOSFET, Parameters of FET, Depletion mode and Enhancement mode, Transfer and Drain Characteristics, Pinch-off voltage, MOSFET as a switch, CMOS as a switch, Elementary idea about rating and packages of common type of power MOSFETs.

Reference Books

- 1- Principal of Electronics-V.K. Mehta
- 2- Basic Electronics- B.L. Thereja
- 3- Basic Electronics and Linear Circuit- Gupta, Bhargav and Kulshresth
- 4- Solid State Electronics- J.P. Agrawal
- 5- Circuit Fundamentals and Basic Electronics- J.P. Agrawal

Paper II: Digital Electronics I

Unit 1- Number System and Codes:

Decimal, Binary, Octal, Hexadecimal number systems and their Inter conversions; One's complement arithmetic, Two's complement arithmetic and its applications; Binary addition, Subtraction, Multiplication and Division, Weighted and Non weighted codes; BCD, Excess-3, Gray code; Alphanumeric codes, ASCII and EBCDIC codes; Unicode

Unit 2- Logic Gates & Logic Families:

Positive and negative logic, AND, OR, NOT, NAND, NOR, EX-OR and EX-NOR gates, Universal gates, Symbols and Truth tables, Venn diagrams, RTL, DTL, TTL, CMOS Parameters (Power dissipation, Speed, Supply requirements), Logic levels, Fan-in, Fan-out, Noise Margin, Noise Immunity and I/O characteristics.

Unit 3- Boolean Algebra:

Laws and Theorems of Boolean Algebra, De-Morgan's Theorems, Canonical form of expressions – Minterm & Maxterm form; Standard SOP and POS simplifications using Boolean Algebra, Universal logic gates; K-map, Simplification by K-map technique, Simplification using VEM technique.

Unit 4- Design of Combinational logic circuits:

Introduction to Logic circuits – Combinational & Sequential; Combinational Circuits such as Half adder, Half Subtractor, Full Adder, Full Subtractor, Encoder, Decoder, Multiplexer, Demultiplexer, Code converters, Binary adders, Two's complement adder and subtractor, Parallel and Serial adders, Seven segment decoder and Display, LCD display, Alphanumeric display, Keypad design, MSI based circuit design

Reference Books

- 1- Digital Design- M. Mano
- 2- Digital Electronics- P. Raja
- 3- Pulse, Digital & Computer Circuits; R Venkatraman
- 4- Digital Electronics- J.S. Katre
- 5- Digital Electronics- R.P. Jain

Semester II

Paper I: Analog Electronics II

Unit 1-Voltage amplifier:

Introduction, CB, CE and CC Amplifiers, Single stage transistor amplifier, Phase reversal, AC load line analysis, Multistage transistor amplifier, Different terms such as Signal, Source, Input, Output, Voltage gain, Current gain, Power gain, Input impedance and Output impedance, Frequency response, Band width, Resonant frequency, RC coupled common emitter amplifier, Loading and Shunting effects, Cascading of stages and its effect on bandwidth, Darlington Pair configuration.

Unit 2- Power amplifier:

Audio power Amplifier, Characteristics of Audio Amplification, Difference between Voltage and Power Amplifier, Performance quantity of power amplifiers (Collector efficiency, Distortion, Power dissipation capacity), Classification of power amplifier (Class A, B and C), Transformer coupled amplifier, Push-Pull amplifiers, complementary Symmetry, Distortion in Amplifiers, Audio amplifiers ICs in common use.

Unit 3-Feedback:

Types of feedback, gain of positive and negative feedback, Effect of negative feedback on amplifier performance (In terms of gain stability, Non-linear distortion, Frequency response, Circuit stability, input and output impedance), Voltage Shunt and Voltage Series feedback, Current Shunt and Current Series feedback, Need of Positive feedback.

Unit 4- Oscillator:

Barkhausen Criteria, Tuned Oscillator, Phase shift Oscillator, Wien's bridge oscillator, Hartley and Colpitts oscillators, Piezo-electric effect, Multivibrators.

Reference Books

- 1- Principal of Electronics-V.K. Mehta
- 2- Basic Electronics- B.L. Thereja
- 3- Basic Electronics and Linear Circuit- Gupta, Bhargava and Kulshresthra
- 4- Solid State Electronics- J.P. Agrawal
- 5- Circuit Fundamentals and Basic Electronics- J.P. Agrawal

Paper II: Analog and Digital Computer Design

Unit 1 – Sequential Circuits:

Concept of Latch & Flip Flop; Types of Flip-Flops: S-R, J-K, MS-JK, D and T, Concept of State Reduction; Registers and counters: Data Register, Shift Register, Synchronous and Asynchronous Counters, Ring Counter, Twisted Ring Counter, Ripple Counter, Up and Down Counter, Decade Counter and Non-Sequential Counter.

Unit 2 - A/D and D/A Converters:

Basics of Conversion – Sampling & Quantization; Basic D/A Converter, R-2R Ladder Method, A/D converter, Types of converters – Open loop type & Closed loop type; Flash conversion

Unit 3- Operational amplifier and its applications:

Characteristics of an ideal OP-AMP, Equivalent circuit, Inverting and Non-Inverting inputs, Virtual ground, Parameters- (Input impedance, Output impedance, Open loop gain, Differential gain, Common mode gain, CMRR, offset voltage, offset null, slew rate, input offset current, Input bias current, Frequency response of an Op-amp), Inverting and non- inverting amplifier, Using Op. amp. as an adder, Subtractor, Comparator, Integrator & Differentiator

Unit 4–Design of Power Supply

Concept of Regulated & Unregulated Power Supply, Design of Regulated power supply using ICs, Basics of Switched Mode Power Supply.

Reference Books

- 1- Digital Design- M. Mano
- 2- Digital Electronics- P. Raja
- 3- Digital Electronics- J.S. Katre
- 4- Digital Electronics- R.P. Jain
- 5- Operational Amplifier- Gayakwad

Semester III

Paper I- Audio Electronics

Unit 1- Microphone & Loudspeaker:

Principle and types of Microphones and Loudspeakers, Woofer, Mid-range and Tweeter; Frequency response, Impedance, Power Rating, Directionality, application areas etc.

Unit 2-Systems and Noise:

Public address systems: need, use and requirements, Typical PA Installation planning.

Noise: Causes of Noise (Environmental noise, Electrical noise), Methods of reducing Noise, Distortion: Type of Distortions, Methods of reducing Distortion.

Concept of Hi-Fi, Pre-amplifier and Stereo System and their components, Dolby systems, Surround Sound and Quadraphonic sound, Surround sound formats, Surround Sound stereo receiver.

Unit 3- Digital Recording and Reproduction:

Introduction to Digital recording, Digitization of sound: PCM, Sampling rate, Resolution, Bit rate, Quantization error, S/N ratio, Nyquist sampling Theory, MIDI interface, Audio data formats, Audio capture, Music/Voice on a computer, Architecture of soundcard, Processing of .WAV and .MIDI files, Introduction to Audio compression techniques: DPCM, ADPCM, SBC, MPEG.

Unit 4- CD Technology:

Disc recording and playback technology, single layer and multilayer discs, recordable and rewritable disc formats, blue ray disc, DVD player, desirable features and outputs of DVD players, Remote control of functions.

Reference Books-

1. Audio and Video Systems - R.G. Gupta
2. Audio Video and T.V. Engineering - Ajay Sharma
3. Audio and Video Systems - Ajay Sharma
4. Electronic Components and Materials - Grover and Jamwal
5. Network Systems - TMH
6. Principal of Electronics - V.K. Mehta
7. Basic Circuit Theory - Chakravarty

Semester III

Paper II-Fundamentals of Programming

Unit 1- Fundamental of computers:

Introduction to computers; Types of Computers; Computer generations, Block diagram of computer-Processor, Memories and its types, I/O devices, Power supply; Software – System Software & Application software; BIOS; Motherboard and its components; CHIP SET- North bridge & South Bridge; Extended and Expanded memory; Bus standards: ISA, EISA, PCI, SCSI; Display Adapter cards – CGA, HGA, VGA, SVGA; Graphics Card; Sound Card

Unit 2-Introductory programming in C language:

Introduction to C language, Structure of C programs, Compilation & execution of C programs, Debugging techniques, Data types & sizes, Declaration of variables, Modifiers, Identifiers & keywords, Symbolic constants; C Language Features: Operators: Unary operators, Arithmetic & Logical operators, Bit-wise operators, Assignment operators and expressions, Conditional expressions, Precedence & order of evaluation; Control statements: If-else, Switch, Break, Continue, Comma operator, Go-to statement; Loops: For, While, Do-while; Functions: Built-in & User-defined, Function declaration, Definition & function call, Parameter passing: Call by value, Call by reference, Recursive functions, Multi-file programs, Command line parameters; Arrays: Linear arrays, Multi-dimensional arrays, Passing arrays to functions, Arrays & Strings; Storage classes: Automatic, External, Register & Static, Enumerations; C Directives: Macros, C pre-processor; Structures & Union: Definition and differences, Self-referential structure; Pointers: Value at (*) and address of (&) operator, Pointer to pointer, Dynamic memory allocation, Calloc & Malloc functions, Array of pointers, Function of pointers, Structures and pointers, Linked list: Single, Double, Circular.

Reference Books-

- 1- Modern Computer Hardware Course - Manohar Lota
- 2- Computer and Languages with “C” - Chanchal Mittal
- 3- Programming in ANSI C - Balaguruswami
- 4- Let us C - Yashwant Kanitkar
- 5- C in depth - Deepali Srivastava

Semester IV

Paper I – Multimedia Technology

Unit1-

Display fundamentals and Terminology; LED and LCD display; Seven Segment display; Basic LED Interfacing; Other types of display – Vacuum Fluorescent, Gas discharge, CRT and TFT.

Unit 2-

Concept of display of character and image on the VDU, Block diagram of a VDU, Various display standards, Technology required for display, Video formats, Basics of video transmission, Interlaced and Non- interlaced scanning.

Unit 3-

Introduction to Multimedia, Storage requirement for multimedia applications, Compression and its importance, Classification of compression techniques.

Unit 4-

Basics of sound, Representation of audio signal, Basics of audio compression techniques, Audio File Formats, Block diagram of a sound blaster card.

Unit 5-

Image concepts and structures; Multimedia compression standard; Basics of video camera, complexity of multimedia functions, General purpose processors and their support for multimedia, Block diagram of dedicated multimedia processor.

Paper II - Power Electronics and Industrial Control

Unit 1- SCR and their Applications:

Introduction, Symbolic representations and Specifications, Principle, Operation and Application of SCR, SCR rating. Theory and Application of DIAC, TRIAC and UJT.

Unit 2- Controlled Rectifiers:

Introduction, Principle of Phase Controlled Converter Operation, Single Phase Semi Converter, Single Phase Full Converter, Single Phase Dual Converters, Single Phase Series Converter, Three Phase Half Wave and Full Wave Converter.

Unit 3-Inverters and Choppers:

Inverters: Introduction, working principle, methods of commutation and methods of connections. Series Inverter.

Choppers: Introduction, DC chopper, AC chopper, Thyristor chopper, Morgan chopper, step up chopper, AC chopper.

Unit 4 – Thyristor Control Circuits:

Introduction, Temperature control, illumination control, automatic street light circuit, Emergency light, automatic water level indicator, automatic battery charger.

Reference Books-

- 1- Power Electronics- Rashid
- 2- Power Electronics- Sunil Kumar
- 3- Power Electronics- P.S. Bimbhra
- 4- Industrial Electronics and Control –S.K. Bhattacharya and S.Chatterjee
- 5- Power and industrial electronics – G K Mithal

Semester V

Paper I –Analog Communication

Unit 1- Modulation and Demodulation:

Need of Modulation and Demodulation, Principle of AM, FM and PM, Modulation index, Modulation Bandwidth and Balanced Modulator,

Unit 2-Telecommunication:

Introduction, Basic Principle of Communication System, Communication Band, Propagation of Electromagnetic Waves (Ground, Sky and Space wave propagation), Ionosphere, Virtual height, Critical frequency and dead zones, Skip distance and maximum usable frequency, Satellite Communication.

Unit 3-Transmitters and Receivers:

Introduction, Function block diagram of AM Transmitter and function of each part, Principle of TRF and Super heterodyne receivers, Block diagram of Super heterodyne AM & FM receivers, selection of IF, Image signals and their rejection, Circuit diagram of different stages

Unit 4. Transmission Lines -:

Distributed parameters, types of transmission lines, Current and Voltage relation, Line distortion and attenuation, Transmission line constants, input Imp. For short and open circuited lines, Power factor, Smith-chart, Coaxial lines. Current and voltage distribution in antenna, definition of parameters like gain, Directional patterns, Bandwidth, Introduction of antenna, Effective Aperture, doubled antenna, Loop antenna, Effective length, resistance and efficiency of antenna.

Reference Books-

- 1- Principal Of Communication Engineering- Anokh Singh, A.K. Chhabra
- 2- Composite Satellite and Cable T.V. R.R. Gulathi
- 3- Electronic Communication- Roodey and Coolen
- 4- Electronic Communication- B.L. Lathi
- 5- Wireless Communication- Rappaport

Semester V

Paper II -Video Electronics

Unit1- Elements of Television System:

Picture transmission, sound transmission, Reception of picture and sound, synchronization Structure, Aspect ratio, Horizontal and vertical scanning, Interlaced scanning, Number of scanning lines, Resolution, Frequency band width requirement.

Unit 2- Composite Video Signals and Signal Transmission:

Scanning sequence details, 625 line systems, Composite video signal waveform, Setting of pedestal height, Horizontal and Vertical sync details, Equalizing pulses, Channel bandwidth, Vestigial side band transmission, Reception bandwidth, Allocation of frequency bands for television signal transmission, Television standards.

Unit 3- B/W Picture tube:

Introduction to picture tubes, Black & white and Color Picture tubes, CCD Image sensors, Beam deflection, Screen phosphor, Face plate, Picture tube characteristics and picture tube control circuits.

Unit 4-

Requirements of TV broadcast transmission, Design, principle and block diagram of transmitter and receiver, commonly used TV antenna and its characteristics.

Unit 5- Colour TV:

Fundamentals of Color TV, three color theory, Luminance, Chrominance, Hue and saturation, Chromaticity diagram, Phosphors for color display, Luminance signal, Color picture tube, Principle of color TV transmission, CCTV – types and applications, Introduction to HDTV, cable TV and DTH.

Reference Books-

- 1- Monochrome and Color T.V. – R.R. Gulati
- 2- Modern T.V. Practice- R.R. Gulati

Semester V

Paper III- Microprocessors

Unit 1-Introduction:

Difference between CPU & Microprocessor; Some terms- Machine cycle, T-State, Instruction cycle, Timing diagram; n-bit, pseudo n-bit and true n-bit microprocessors; Physical significance of size of the buses of a microprocessor; Classification of Microprocessors; Essential & Non-essential components of a microprocessor; Basic functional block diagram of a microprocessor; Basic Operations performed by any microprocessor; Instruction Set and Addressing modes; Concept of scalar processor and scalar pipeline processor, Difference between RISC & CISC processor, Concept of Co-processors, Comparative study of 8 bit microprocessors- 8080, 8085, 6800 and Z-80; Interrupts and its types.

Unit 2– Introduction to 8085:

Basic block diagram of 8085, Features of 8085, Register Architecture of 8085, Generation of Programming Languages, Introduction to Assembly Language Programming, Instruction set: Data transfer, Arithmetic and Logical operation set, Simple Programs like Addition, Subtraction, Multiplication, Division, Compliments, Comparison, rotation, Swapping, Data transfer; Time delay Subroutine program

Unit 3- Introduction to 16-bit and 32-bit microprocessors:

Basic block diagram of 8086 and 8088; Features of 8086; Basic block diagram of 80286; Basic block diagram of 80386; Concept of Super-pipeline and Super-scalar processors; Introduction to Pentium Processors.

Reference Books-

- 1- Microprocessor Architecture- Ramesh S. Gaonkar
- 2- Microprocessors- P. Raja
- 3- Introduction to Microprocessors – Mathur B.C.
- 4- Introduction to Microprocessors - Gaonkar

Semester VI

Paper I –Digital Communication

Unit 1- Pulse Analog Modulation

Sampling theorem, Errors in sampling, Pulse Amplitude Modulation (PAM), time division Multiplexing (TDM), Pulse width Modulation (PWM), and Pulse Position Modulation (PPM), Generation and detection of PAM, PWM, PPM.

Unit 2-Pulse Code Modulation

Need for digital transmission, Quantizing, Uniform and Non-uniform Quantization, Quantization Noise and bit error rate. Differential pulse code modulation, Delta modulation, Quantization noise, Adaptive Delta Modulation, Time division Multiplexing (TDM), T1/E1 carrier system.

Unit-3: Digital carrier Modulation Techniques-:

Block diagram of digital transmission and reception, Information capacity, Bit rate and Baud rate and M-ary coding, Amplitude Shift keying (ASK), Frequency shift keying (FSK), Phase shift keying (PSK), Binary PSK (BPSK), and Quadrature phase shift keying (QPSK).

Unit 4: Multiple Access Techniques-:

Concept of Frequency Division Multiple Access (FDMA), Code division Multiple Access (CDMA)

Overview of Modern Communication systems – Mobile communication, Satellite communication and optical communication.

Reference Books

- 1- Principal Of Communication Engineering- Anokh Singh, A.K. Chhabra
- 2- Antenna and Wave Propagation- U.A. Bakshi
- 3- Composite Satellite and Cable T.V. R.R. Gulathi
- 4- Electronic Communication- Roodey and Coolen
- 5- Electronic Communication- B.L. Lathi
- 6- Wireless Communication- Rappaport
- 7- Opto Electronics- Wilson Hawks

Paper II- Electronic Instrumentation

Unit 1- Measurement of Voltage, Current and Resistance:

Electronic Voltmeters and its applications, Circuit diagrams based on differential Amplifier using transistor, FET- IC and their comparison, True r.m.s Voltmeter. Electronic Voltmeter: Block diagram and working of different types of DVM, RAMP types DVM, Integrating type DVM, Potentiometric type DVM and dual slope integration type DVM

Unit 2- Bridge measurements of R, L & C:

Introduction to AC measuring Bridges, Balance Condition. Types of sources and detectors. Resistance measuring AC Bridges, Maxwell's Induction Bridge, Hayes Bridge, Inductance comparison bridge. Capacitance Comparison Bridge. LCR / impedance meter.

Unit 3- Cathode Ray Oscillating-:

Introduction, CRO tube, Block diagram of CRO and its working, Time base generator, Oscilloscope controls and their location in circuit diagram, Double beam Oscilloscopes, Measurement of voltage and Frequency, Wave form analysis by CRO.

Unit 4-Transducers:

Introduction, Basic requirement of transducers, Classification of transducers, Transducers in Instrumentation and control systems, Types of transducers, Piezoelectric Transducer.

Reference Books

- 1- Instrumentation Devices and Systems- Rangan Sharma
- 2- Instrumentation- Kalsi
- 3- Electronic and Electrical Measurements and Instrumentation- J.B. Gupta
- 4- Electronic and Electrical Measurements and Instrumentation-A.K. Sawhani
- 5- Filter And Transmission Lines- P.K. Jain

Paper III- Computer Organization & Architecture

Unit 1- Memories and its interfacing:

Memory Hierarchy, Classification of memories; Primary memories: RAM (DRAM, SRAM), ROM (PROM, EPROM, EEPROM, Masked ROM and Flash memory), Secondary memories: Hard Disc, Optical Disk, Floppy Disk; Design of basic memory cell, Cell Organization- Word & coincidence organization, Memory Interleaving -High order and low order interleaving; Interfacing RAM & ROM

Unit 2: I/O Devices & its interfacing:

Input/Output Devices; Keyboard – Multiplexed/Non-multiplexed, Mouse; Output devices: Printers – Serial/Parallel, Block Diagram of VDU, I/O methods – Direct & Indirect – Memory Mapped and I/O Mapped, Types of D.MA; Concept of Serial & Parallel Interfacing; Synchronous & asynchronous communication; Usage of Programmable peripheral chips: PPI (8255) and USART (8251)

Unit 3: Operating System:

Definition and type of OS, Modules of OS, Booting (Cold boot, Warm boot), BIOS, Introduction of DOS; Memory management techniques: Relocation, Swapping, Partitioning, Paging, Segmentation, Concept of memory fragmentation, Combined schemes; Concept of virtual memory, Page replacement techniques

Unit 4: Concept of Networking:

Advantages and Disadvantages of Networking, Classification of networks, Protocols and its importance, Concept of Layered Approach to design – ISO/OSI & TCP/IP, Classful & Classless addressing; Network Security

Reference Books-

- 1- Modern Computer Hardware Course- Manohar Lotia
- 2- Computer and Languages with “C”- Chanchal Mittal
- 3- Operating System- Galvin
- 4- Microprocessor Architecture- Ramesh S. Gaonkar

SKILL ENHANCEMENT COURSE (SEC)

CONTROL SYSTEMS

UNIT 1- CONCEPTS OF CONTROL SYSTEM DESIGN

Definition of System, Classification of Systems, Characteristics of systems, Open loop and Closed Loop systems, Real-time and Non-real time systems, Embedded systems, Feedback and its effect, Transfer function, Signal flow graph, Reduction using Mason's gain formula, Block diagram design and Block reduction, Concept of system stability, compensation techniques – lag, Lead and Lag-Lead control, Design of PID controllers.

UNIT 2 – ELEMENTS OF CONTROL SYSTEMS

Sensors and its types, Actuator and its types, controller and its types, Difference between Analog and Digital control systems, gain margin and Phase Margin of a system, Features of a control systems, Design requirement – Processor, memory, sensor, LED, LCD, 7 Segment keypad design, Power supply unit design, Clock circuit, Debug port, watching timer, Signal conditioning techniques, OP-AMP and its uses, Recent trends in control systems.

UNIT 3- PERFORMANCE OF A CONTROL SYSTEM

Communication interfaces – Serial interface, USB, infrared, Ethernet, IEEE 802.11, Bluetooth, Zigbee, Design of power Supply unit, Software for Embedded system, Architecture of Embedded OS, Introduction to Development tools and Productivity tools, Actual design of an Embedded systems, Testing on Host systems, Testing on Target system.

Reference :-

1. Digital Control System – Benjamin C Kuo (Oxford University Press)
2. Real-time System Analysis and Design – Philip A Lapante (Wiley)
3. Real-time System Design – Rajib Mall (Pearson)