Choice Based Credit System (CBCS)

UNIVERSITY OF DELHI

FACULTY OF INTER-DISCIPLINARY & APPLIED SCIENCES

UNDERGRADUATE PROGRAMME
(Courses effective from Academic Year 2015-16)

SYLLABUS OF COURSES TO BE OFFERED
Core Courses, Elective Courses & Ability Enhancement Courses

Disclaimer: The CBCS syllabus is uploaded as given by the Faculty concerned to the Academic Council. The same has been approved as it is by the Academic Council on 13.7.2015 and Executive Council on 14.7.2015. Any query may kindly be addressed to the concerned Faculty.

Undergraduate Programme Secretariat
Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching–learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.
CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student’s performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. Elective Course: Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate’s proficiency/skill is called an Elective Course.
   2.1 Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
   2.2 Dissertation/Project: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
   2.3 Generic Elective (GE) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.
      P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
3. Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course: The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). “AECC” courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AECC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
   3.1 AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.
   3.2 AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.
Details of courses under B.A (Honors), B.Com (Honors) & B.Sc. (Honors)

<table>
<thead>
<tr>
<th>Course</th>
<th>*Credits</th>
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<tbody>
<tr>
<td></td>
<td>Theory+ Practical</td>
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<td>--------------------------------------</td>
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<tr>
<td>I. Core Course</td>
<td></td>
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<tr>
<td>(14 Papers)</td>
<td>14X4= 56</td>
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<tr>
<td>Core Course Practical / Tutorial*</td>
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<tr>
<td>(14 Papers)</td>
<td>14X2=28</td>
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<tr>
<td>II. Elective Course</td>
<td></td>
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<tr>
<td>(8 Papers)</td>
<td></td>
</tr>
<tr>
<td>A.1. Discipline Specific Elective</td>
<td>4X4=16</td>
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<tr>
<td>A.2. Discipline Specific Elective</td>
<td>4 X 2=8</td>
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<tr>
<td>(4 Papers)</td>
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<tr>
<td>B.1. Generic Elective/ Interdisciplinary</td>
<td>4X4=16</td>
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<tr>
<td>(4 Papers)</td>
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<tr>
<td>B.2. Generic Elective</td>
<td>4 X 2=8</td>
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<tr>
<td>(4 Papers)</td>
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<tr>
<td>• Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6th Semester</td>
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<tr>
<td>III. Ability Enhancement Courses</td>
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</tr>
<tr>
<td>1. Ability Enhancement Compulsory</td>
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<tr>
<td>(2 Papers of 2 credit each)</td>
<td>2 X 2=4</td>
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<tr>
<td>Environmental Science</td>
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<tr>
<td>English/MIL Communication</td>
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<tr>
<td>2. Ability Enhancement Elective (Skill Based)</td>
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<tr>
<td>(Minimum 2)</td>
<td>2 X 2=4</td>
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<tr>
<td>(2 Papers of 2 credit each)</td>
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<tr>
<td>Total credit</td>
<td>140</td>
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</tbody>
</table>

Institute should evolve a system/policy about ECA/ General Interest/Hobby/Sports/NCC/NSS/related courses on its own.

* wherever there is a practical there will be no tutorial and vice-versa
CORE COURSE(C): (Credit: 06 each) (1 period/week for tutorials or 4 periods/week for practical)

I. Basic Circuit Theory and Network Analysis (4+4)
II. Mathematics Foundation for Electronics (4+4)
III. Semiconductor Devices (4+4)
IV. Applied Physics (4+4)
V. Electronic Circuits (4+4)
VI. Digital Electronics and VHDL (4+4)
VII. C Programming and Data Structures (4+4)
VIII. Operational Amplifiers and Applications (4+4)
IX. Signals and Systems (4+4)
X. Electronic Instrumentation (4+4)
XI. Microprocessors and Microcontrollers (4+4)
XII. Electromagnetics (4+4)
XIII. Communication Electronics (4+4)
XIV. Photonics (4+4)

NOTE: Core Courses No. I, VI and VIII are common with B.Sc. (Hons) Instrumentation
Discipline Specific Electives (DSE): (Credit: 06 each) (4 papers to be selected) - DSE 1-4

1. Power Electronics (4+4)
2. Numerical Analysis (4+4)
3. Modern Communication Systems (4+4)
4. Semiconductor Fabrication and Characterization (4+4)
5. Electrical Machines (4+4)
6. Basic VLSI Design (4+4)
7. Digital Signal Processing (4+4)
8. Control Systems (4+4)
9. Computer Networks (4+4)
10. Embedded Systems (4+4)
11. Biomedical Instrumentation (4+4)
12. Transmission Lines, Antenna and Wave Propagation (4+4)
13. Dissertation (4+4)

Skill Enhancement Course (SEC) (02 papers) (Credit: 02 each) - SEC1 to SEC2

1. Design and Fabrication of Printed Circuit Boards (4)
2. Robotics (4)
3. Mobile Applications Development (4)
4. Internet and Java Programming (4)
5. Programming with LabVIEW (4)

Other Discipline - GE 1 to GE 4

1. Mathematics
2. Computer Science
3. Physics
4. Biomedical Science
5. Chemistry
6. Commerce

Any other discipline of Choice

Generic Elective Papers (GE) for other Departments/Disciplines: (Credit: 06 each)

1. Electronic Circuits and PCB Designing (4+4)
2. Digital System Design (4+4)
3. Instrumentation (4+4)
4. Practical Electronics (4+4)
5. Communication Systems (4+4)
7. Consumer Electronics (4+4)

Important:

1. The size of the practical group for practical papers is recommended to be 12-15 students.
Core course-I
Basic Circuit Theory and Network Analysis
(Credits: Theory-04, Practicals-02)
Theory Lectures 60

Unit- 1

Capacitors: Principles of capacitance, Parallel plate capacitor, Permittivity, Definition of Dielectric Constant, Dielectric strength, Energy stored in a capacitor, Air, Paper, Mica, Teflon, Ceramic, Plastic and Electrolytic capacitor, Construction and application, capacitors in series and parallel, factors governing the value of capacitors, testing of capacitors using multimeter.

Unit- 2

Circuit Analysis: Kirchhoff’s Current Law (KCL), Kirchhoff’s Voltage Law (KVL), Node Analysis, Mesh Analysis, Star-Delta Conversion.
DC Transient Analysis: RC Circuit- Charging and discharging with initial charge, RL Circuit with Initial Current, Time Constant, RL and RC Circuits With Sources, DC Response of Series RLC Circuits.

Unit-3


Unit-4

Network Theorems: Principal of Duality, Superposition Theorem, Thevenin’s Theorem, Norton’s Theorem, Reciprocity Theorem, Millman’s Theorem, Maximum Power Transfer Theorem. AC circuit analysis using Network theorems.
Two Port Networks: Impedance (Z) Parameters, Admittance (Y) Parameters, Transmission (ABCD) Parameters.

Suggested books:
Basic Circuit Theory and Network Analysis Lab (Hardware and Circuit Simulation Software)

60 Lectures

1. Familiarization with
   a) Resistance in series, parallel and series – Parallel.
   b) Capacitors & Inductors in series & Parallel.
   c) Multimeter – Checking of components.
   d) Voltage sources in series, parallel and series – Parallel
   e) Voltage and Current dividers

2. Measurement of Amplitude, Frequency & Phase difference using CRO.
3. Verification of Kirchoff’s Law.
4. Verification of Norton’s theorem.
5. Verification of Thevenin’s Theorem.
6. Verification of Superposition Theorem.
7. Verification of the Maximum Power Transfer Theorem.
8. RC Circuits: Time Constant, Differentiator, Integrator.
11. Study of the Frequency Response of a Series LCR Circuit and determination of its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width.
Core course-II
Mathematics Foundation for Electronics
(Credits: Theory-04, Practicals-02)
Theory Lectures 60

Unit-1


Series solution of differential equations and special functions: Power series method, Legendre Polynomials, Frobenius Method, Bessel’s equations and Bessel’s functions of first and second kind. Error functions and gamma function.

Unit-2


Unit-3


Unit-4


Suggested Books

1. E. Kreyszig, advanced engineering mathematics, Wiley India (2008)
Mathematics Foundation for Electronics Lab (Scilab/MATLAB/ any other Mathematical Simulation software)

60 Lectures

1. Solution of First Order Differential Equations
2. Solution of Second Order homogeneous Differential Equations
3. Solution of Second Order non-homogeneous Differential Equations
5. Divergence of a given series.
Core course-III
Semiconductor Devices
(Credits: Theory-04, Practicals-02)

Unit 1

Carrier Transport Phenomena: Carrier Drift, Mobility, Resistivity, Hall Effect, Diffusion Process, Einstein Relation, Current Density Equation, Carrier Injection, Generation And Recombination Processes, Continuity Equation.

Unit 2

Tunnel diode, varactor diode, solar cell: circuit symbol, characteristics, applications

Unit 3

Metal Semiconductor Junctions: Ohmic and Rectifying Contacts.

Unit 4

Field Effect Transistors: JFET, Construction, Idea of Channel Formation, Pinch-Off and Saturation Voltage, Current-Voltage Output Characteristics. MOSFET, types of MOSFETs, Circuit symbols, Working and Characteristic curves of Depletion type MOSFET (both N channel and P Channel) and Enhancement type MOSFET (both N channel and P channel). Complimentary MOS (CMOS).

Suggested Books:

Semiconductor Devices Lab (Hardware and Circuit Simulation Software)

60 Lectures

2. Study of the I-V Characteristics of the CE configuration of BJT and obtain $r_i$, $r_o$, $\beta$.
3. Study of the I-V Characteristics of the Common Base Configuration of BJT and obtain $r_i$, $r_o$, $\alpha$.
4. Study of the I-V Characteristics of the Common Collector Configuration of BJT and obtain voltage gain, $r_i$, $r_o$.
5. Study of the I-V Characteristics of the UJT.
6. Study of the I-V Characteristics of the SCR.
7. Study of the I-V Characteristics of JFET.
8. Study of the I-V Characteristics of MOSFET.
9. Study of Characteristics of Solar Cell
10. Study of Hall Effect.
Core course-IV
Applied Physics
(Credits: Theory-04, Practicals-02)

Unit Lectures 60

Unit-1


Unit-2


Unit-3


Unit-4


Suggested Books:

1. To determine Young’s modulus of a wire by optical lever method.
2. To determine the modulus of rigidity of a wire by Maxwell’s needle.
3. To determine the elastic constants of a wire by Searle’s method.
4. To measure the resistivity of a Ge crystal with temperature by four–probe method from room temperature to 200°C.
5. To determine the value of Boltzmann Constant by studying forward characteristics of diode.
6. To determine the value of Planck’s constant by using LEDs of at least 4 different wavelengths.
7. To determine $e/m$ of electron by Bar Magnet or by Magnetic Focusing.
Core course-V
Electronics Circuits
(Credits: Theory-04, Practicals-02)

Unit- 1 (14 Lectures)


Unit- 2 (15 Lectures)

Bipolar Junction Transistor: Review of CE, CB Characteristics and regions of operation. Hybrid parameters. Transistor biasing, DC load line, operating point, thermal runaway, stability and stability factor. Fixed bias without and with RE, collector to base bias, voltage divider bias and emitter bias (+VCC and –VEE bias), circuit diagrams and their working. Transistor as a switch, circuit and working, Darlington pair and its applications. BJT amplifier (CE), dc and ac load line analysis, hybrid model of CE configuration, Quantitative study of the frequency response of a CE amplifier, Effect on gain and bandwidth for Cascaded CE amplifiers (RC coupled).

Unit- 3 (13 Lectures)

Feedback Amplifiers: Concept of feedback, negative and positive feedback, advantages and disadvantages of negative feedback, voltage (series and shunt), current (series and shunt) feedback amplifiers, gain, input and output impedances. Barkhausen criteria for oscillations, Study of phase shift oscillator, Colpitts oscillator and Hartley oscillator.

Unit- 4 (18 Lectures)


Suggested Books:

2. Electronic devices, David A Bell, Reston Publishing Company
8. Allen Mottershed, Electronic Devices and Circuits, Goodyear Publishing Corporation

Electronics Circuits Lab (Hardware and Circuit Simulation Software)
60 Lectures

1. Study of the half wave rectifier and Full wave rectifier.
2. Study of power supply using C filter and Zener diode.
3. Designing and testing of 5V/9 V DC regulated power supply and find its load-regulation
4. Study of clipping and clamping circuits.
5. Study of Fixed Bias, Voltage divider and Collector-to-Base bias Feedback configuration for transistors.
7. Study of Class A, B and C Power Amplifier.
8. Study of the Colpitt’s Oscillator.
10. Study of the Phase Shift Oscillator
Core course-VI  
Digital Electronics and VHDL  
(Credits: Theory-04, Practicals-02)  

Theory Lectures 60

Unit-1  
(11 Lectures)

**Number System and Codes:** Decimal, Binary, Hexadecimal and Octal number systems, base conversions, Binary, octal and hexadecimal arithmetic (addition, subtraction by complement method, multiplication), representation of signed and unsigned numbers, Binary Coded Decimal code.

**Logic Gates and Boolean algebra:** Introduction to Boolean Algebra and Boolean operators, Truth Tables of OR, AND, NOT, Basic postulates and fundamental theorems of Boolean algebra, Truth tables, construction and symbolic representation of XOR, XNOR, Universal (NOR and NAND) gates.

**Digital Logic families:** Fan-in, Fan out, Noise Margin, Power Dissipation, Figure of merit, Speed power product, TTL and CMOS families and their comparison.

Unit-2  
(13 Lectures)

**Combinational Logic Analysis and Design:** Standard representation of logic functions (SOP and POS), Karnaugh map minimization, Encoder and Decoder, Multiplexers and Demultiplexers, Implementing logic functions with multiplexer, binary Adder, binary subtractor, parallel adder/subtractor.

Unit-3  
(18 Lectures)

**Sequential logic design:** Latches and Flip flops, S-R Flip flop, J-K Flip flop, T and D type Flip flop, Clocked and edge triggered Flip flops, master slave flip flop, Registers, Counters (synchronous and asynchronous and modulo-N), State Table, State Diagrams, counter design using excitation table and equations, Ring counter and Johnson counter.

**Programmable Logic Devices:** Basic concepts- ROM, PLA, PAL, CPLD, FPGA

Unit-4  
(18 Lectures)

**Introduction to VHDL:** A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and Verilog, Introduction to Simulation and Synthesis Tools, Test Benches. VHDL Modules, Delays, data flow style, behavioral style, structural style, mixed design style, simulating design.

Introduction to Language Elements, Keywords, Identifiers, White Space Characters, Comments, format. VHDL terms, describing hardware in VHDL, entity, architectures, concurrent signal assignment, event scheduling, statement concurrency, structural designs, sequential behavior, process statements, process declarative region, process statement region, process execution, sequential statements, architecture selection, configuration statements, power of configurations.

**Behavioral Modeling:** Introduction to behavioral modeling, inertial delay, transport delay, inertial delay model, transport delay model, transport vs inertial delay, simulation delta drivers, driver creation, generics, block statements, guarded blocks.

**Sequential Processing:** Process statement, sensitivity list, signal assignment vs variable assignment, sequential statements, IF, CASE, LOOP, NEXT, EXIT and ASSERT statements, assertion BNF, WAIT ON signal, WAIT UNTIL expression, WAIT FOR time expression, multiple wait conditions, WAIT Time-Out, Sensitivity List vs WAIT Statement Concurrent Assignment, Passive Processes.
**Data types:** Object types-signal, variable, constant, Data types –scalar types, composite types, incomplete types, File Type caveats, subtypes, Subprograms and functions

**Suggested Books:**

**Digital Electronics and VHDL Lab (Hardware and Circuit Simulation Software)**
**60 lectures**
1. To verify and design AND, OR, NOT and XOR gates using NAND gates.
2. To convert a Boolean expression into logic gate circuit and assemble it using logic gate IC’s.
3. Design a Half and Full Adder.
4. Design a Half and Full Subtractor.
5. Design a seven segment display driver.
6. Design a 4 X 1 Multiplexer using gates.
7. To build a Flip- Flop Circuits using elementary gates. (RS, Clocked RS, D-type).
9. Design a shift register and study Serial and parallel shifting of data.

**Experiments in VHDL**
1. Write code to realize basic and derived logic gates.
2. Half adder, Full Adder using basic and derived gates.
3. Half subtractor and Full Subtractor using basic and derived gates.
4. Clocked D FF, T FF and JK FF (with Reset inputs).
5. Multiplexer (4x1, 8x1) and Demultiplexer using logic gates.
6. Decoder (2x4, 3x8), Encoders and Priority Encoders.
7. Design and simulation of a 4 bit Adder.
8. Code converters (Binary to Gray and vice versa).
9. 2 bit Magnitude comparator.
10. 3 bit Ripple counter.
Core course-VII
C Programming and Data Structures
(Credits: Theory-04, Practicals-02)

Unit-1

C Programming Language: Introduction, Importance of C, Character set, Tokens, keywords, identifier, constants, basic data types, variables: declaration & assigning values. Structure of C program
Arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, bit wise operators, expressions and evaluation of expressions, type cast operator, implicit conversions, precedence of operators. Arrays-concepts, declaration, accessing elements, storing elements, two-dimensional and multi-dimensional arrays. Input output statement and library functions (math and string related functions).

Unit-2

Decision making, branching & looping: Decision making, branching and looping: if, if-else, else-if, switch statement, break, for loop, while loop and do loop. Functions: Defining functions, function arguments and passing, returning values from functions.
Structures: defining and declaring a structure variables, accessing structure members, initializing a structure, copying and comparing structure variables, array of structures, arrays within structures, structures within structures, structures and functions. Pointers.
Introduction to C++: Object oriented programming, characteristics of an object-oriented language.

Unit-3

Data Structures: Definition of stack, array implementation of stack, conversion of infix expression to prefix, postfix expressions, evaluation of postfix expression. Definition of Queue, Circular queues, Array implementation of queues. Linked List and its implementation, Link list implementation of stack and queue, Circular and doubly linked list.

Unit-4

Searching and sorting: Insertion sort, selection sort, bubble sort, merge sort, linear Search, binary search.
Trees: Introduction to trees, Binary search tree, Insertion and searching in a BST, preorder, postorder and inorder traversal (recursive)

Suggested Books:

1. Yashavant Kanetkar, Let Us C , BPB Publications
3. Byron S Gottfried, Programming with C , Schaum Series
C Programming and Data Structures Lab
60 Lectures

1. Generate the Fibonacci series up to the given limit N and also print the number of elements in the series.
2. Find minimum and maximum of N numbers.
3. Find the GCD of two integer numbers.
4. Calculate factorial of a given number.
5. Find all the roots of a quadratic equation $Ax^2 + Bx + C = 0$ for non-zero coefficients A, B and C. Else report error.
6. Calculate the value of $\sin(x)$ and $\cos(x)$ using the series. Also print $\sin(x)$ and $\cos(x)$ value using library function.
7. Generate and print prime numbers up to an integer N.
8. Sort given N numbers in ascending order.
9. Find the sum & difference of two matrices of order MxN and PxQ.
10. Find the product of two matrices of order MxN and PxQ.
11. Find the transpose of given MxN matrix.
12. Find the sum of principle and secondary diagonal elements of the given MxN matrix.
13. Calculate the subject wise and student wise totals and store them as a part of the structure.
14. Maintain an account of a customer using classes.
15. Implement linear and circular linked lists using single and double pointers.
16. Create a stack and perform Pop, Push, Traverse operations on the stack using Linear Linked list
17. Create circular linked list having information about a college and perform Insertion at front, Deletion at end.
18. Create a Linear Queue using Linked List and implement different operations such as Insert, Delete, and Display the queue elements.
19. Implement polynomial addition and subtraction using linked lists.
20. Implement sparse matrices using arrays and linked lists.
21. Create a Binary Tree to perform Tree traversals (Preorder, Postorder, Inorder) using the concept of recursion.
22. Implement binary search tree using linked lists. Compare its time complexity over that of linear search.
23. Implement Insertion sort, Merge sort, Bubble sort, Selection sort.
Core course-VIII
Operational Amplifiers and Applications
(Credits: Theory-04, Practicals-02)

Unit-1

Basic Operational Amplifier: Concept of differential amplifiers (Dual input balanced and unbalanced output), constant current bias, current mirror, cascaded differential amplifier stages with concept of level translator, block diagram of an operational amplifier (IC 741)

Op-Amp parameters: input offset voltage, input offset current, input bias current, differential input resistance, input capacitance, offset voltage adjustment range, input voltage range, common mode rejection ratio, slew rate, supply voltage rejection ratio.

Unit-2

Op-Amp Circuits: Open and closed loop configuration, Frequency response of an op-amp in open loop and closed loop configurations, Inverting, Non-inverting, Summing and difference amplifier, Integrator, Differentiator, Voltage to current converter, Current to voltage converter.
Comparators: Basic comparator, Level detector, Voltage limiters, Schmitt Trigger.
Signal generators: Phase shift oscillator, Wein bridge oscillator, Square wave generator, triangle wave generator, saw tooth wave generator, and Voltage controlled oscillator(IC 566).

Unit-3

Multivibrators (IC 555): Block diagram, Astable and monostable multivibrator circuit, Applications of Monostable and Astable multivibrators. Phase locked loops (PLL): Block diagram, phase detectors, IC565.

Fixed and variable IC regulators: IC 78xx and IC 79xx -concepts only, IC LM317- output voltage equation

Unit-4

Signal Conditioning circuits: Sample and hold systems, Active filters: First order low pass and high pass butterworth filter, Second order filters, Band pass filter, Band reject filter, All pass filter, Log and antilog amplifiers.

Suggested Books:

Operational Amplifiers and Application Lab (Hardware and Circuit Simulation Software)
60 Lectures

1. Study of op-amp characteristics: CMRR and Slew rate.
2. Designing of an amplifier of given gain for an inverting and non-inverting configuration using an op-amp.
3. Designing of analog adder and subtractor circuit.
4. Designing of an integrator using op-amp for a given specification and study its frequency response.
5. Designing of a differentiator using op-amp for a given specification and study its frequency response.
7. Designing of a First Order High-pass filter using op-amp.
9. Study of IC 555 as an astable multivibrator.
10. Study of IC 555 as monostable multivibrator.
11. Designing of Fixed voltage power supply using IC regulators using 78 series and 79 series
Core course-IX
Signals & Systems
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1
(17 Lectures)

Signals and Systems: Continuous and discrete time signals, Transformation of the independent variable, Exponential and sinusoidal signals, Impulse and unit step functions, Continuous-Time and Discrete-Time Systems, Basic System Properties.

Unit-2
(13 Lectures)

Linear Time-Invariant Systems (LTI): Discrete time LTI systems, the Convolution Sum, Continuous time LTI systems, the Convolution integral. Properties of LTI systems, Commutative, Distributive, Associative. LTI systems with and without memory, Invariability, Causality, Stability, Unit Step response. Differential and Difference equation formulation, Block diagram representation of first order systems.

Unit-3
(18 Lectures)


Unit-4
(12 Lectures)


Suggested Books:

Signals & Systems Lab (Scilab/MATLAB/ Other Mathematical Simulation software)

60 Lectures

1. Generation of Signals: continuous time
2. Generation of Signals: discrete time
3. Time shifting and time scaling of signals.
4. Convolution of Signals
5. Solution of Difference equations.
6. Fourier series representation of continuous time signals.
7. Fourier transform of continuous time signals.
8. Laplace transform of continuous time signals.
9. Introduction to Xcos/similar function and calculation of output of systems represented by block diagrams
Core course-X
Electronic Instrumentation
(Credits: Theory-04, Practicals-02)

Unit-1 (15 Lectures)

**Qualities of Measurement:** Specifications of instruments, their static and dynamic characteristics, Error (Gross error, systematic error, absolute error and relative error) and uncertainty analysis. Statistical analysis of data and curve fitting.

**Basic Measurement Instruments:** PMMC instrument, galvanometer, DC measurement - ammeter, voltmeter, ohm meter, AC measurement, Digital voltmeter systems (integrating and non-integrating types), digital multimeters, digital frequency meter system (different modes and universal counter).

**Connectors and Probes:** low capacitance probes, high voltage probes, current probes, identifying electronic connectors – audio and video, RF/Coaxial, USB etc.

Unit-2 (15 Lectures)


**A-D and D-A Conversion:** 4 bit binary weighted resistor type D-A conversion, circuit and working. Circuit of R-2R ladder. A-D conversion characteristics, successive approximation ADC. (Mention of relevant ICs for all).

Unit-3 (16 Lectures)

**Oscilloscopes:** CRT, wave form display and electrostatic focusing, time base and sweep synchronization, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Dual trace oscilloscope, Sampling Oscilloscope, DSO and Powerscope: Block diagram, principle and working, Advantages and applications, CRO specifications (bandwidth, sensitivity, rise time).

**Signal Generators:** Audio oscillator, Pulse Generator, Function generators.

Unit-4 (14 Lectures)

**Transducers and sensors:** Classification of transducers, Basic requirement/characteristics of transducers, active & passive transducers, Resistive (Potentiometer, Strain gauge – Theory, types, temperature compensation and applications), Capacitive (Variable Area Type – Variable Air Gap type – Variable Permittivity type), Inductive (LVDT ) and piezoelectric transducers.

Measurement of displacement, velocity and acceleration (translational and rotational). Measurement of pressure (manometers, diaphragm, bellows), Measurement of temperature (RTD, thermistor, thermocouple, semiconductor IC sensors), Light transducers (photoresistors, photovoltaic cells, photodiodes).

**Suggested Books:**
1. H. S. Kalsi, Electronic Instrumentation, TMH(2006)
2. W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice-
3. Instrumentation Measurement and analysis: Nakra B C, Chaudry K, TMH

Electronic Instrumentation Lab

60 Lectures

1. Design of multi range ammeter and voltmeter using galvanometer.
4. Measure of low resistance by Kelvin’s double bridge.
5. To determine the Characteristics of resistance transducer - Strain Gauge (Measurement of Strain using half and full bridge.)
6. To determine the Characteristics of LVDT.
7. To determine the Characteristics of Thermistors and RTD.
8. Measurement of temperature by Thermocouples and study of transducers like AD590 (two terminal temperature sensor), PT-100, J-type, K-type.
9. To study the Characteristics of LDR, Photodiode, and Phototransistor:
   (i) Variable Illumination.
   (ii) Linear Displacement.
10. Characteristics of one Solid State sensor/ Fiber optic sensor
Core course-XI
Microprocessor and Microcontrollers
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1 (18 Lectures)

**Introduction to Microprocessor:** Introduction, Applications, Basic block diagram, Speed, Word size, Memory capacity, Classification of microprocessors (mention of different microprocessors being used)

**Microprocessor 8085:** Features, Architecture, -block diagram, General purpose registers, register pairs, flags, stack pointer, program counter, types of buses. Multiplexed address and data bus, generation of control signals, pin description of microprocessor 8085. Basic interfacing concepts, Memory mapped I/O and I/O mapped I/O.

**8085 Instructions:** Operation code, Operand & Mnemonics. Instruction set of 8085, instruction classification, addressing modes, instruction format. Data transfer instructions, arithmetic instructions, increment & decrement instructions, logical instructions, branch instructions and machine control instructions. Assembly language programming examples.

Unit-2 (10 Lectures)

Stack operations, subroutine, call and return instructions. Delay loops, use of counters, timing diagrams-instruction cycle, machine cycle, T- states, time delay.

Interrupt structure of 8085A microprocessor, processing of vectored and non-vectored interrupts, latency time and response time; Handling multiple interrupts

**Microcontrollers:** Introduction, different types of microcontrollers, embedded microcontrollers, processor architectures. Harvard vs. Princeton, CISC vs. RISC architectures, microcontroller memory types, microcontroller features, clocking, I/O pins, interrupts, timers, peripherals.

Unit-3 (18 Lectures)

**PIC16F887 Microcontroller:** Core features, Architecture, pin diagram, memory organization- Program and data memory organization, I/O Ports, oscillator module, Timer modules (Timer 0, Timer 1 and Timer 2), comparator module, analog-to-digital converter (ADC) module, data EEPROM, Enhanced capture/compare/PWM module, EUSART, master synchronous serial port (MSSP) module, special features of the CPU, interrupts, addressing modes, instruction set.

Unit-4 (14 Lectures)

**Interfacing to PIC16F887:** LED, Switches, Solid State Relay, Seven Segment Display, 16x2 LCD display, 4x4 Matrix Keyboard, Digital to Analog Converter, Stepper Motor and DC Motor. Interfacing program examples using C language.

**Suggested Books:**

3. Microchip PIC16F87X datasheet
Microprocessor and Microcontrollers Lab
60 Lectures

8085 Assembly language programs:
1. Program to transfer a block of data.
2. Program for multibyte addition
3. Program for multibyte subtraction
4. Program to multiply two 8-bit numbers.
5. Program to divide a 16 bit number by 8 bit number.
6. Program to search a given number in a given list.
7. Program to generate terms of Fibonacci series.
8. Program to find minimum and maximum among N numbers
9. Program to find the square root of an integer.
10. Program to find GCD of two numbers.
11. Program to sort numbers in ascending/descending order.
12. Program to verify the truth table of logic gates.

PIC Microcontroller Programming
Note: Programs to be written using C programming language

1. LED blinking with a delay of 1 second.
2. Solid State Relay Interface
3. Interfacing of LCD (2X16).
4. Interfacing of stepper motor and Rotating stepper motor by N steps clockwise/anticlockwise with speed control.
5. To test all the gates of a given IC74XX is good or bad.
6. Generate sine, square, saw tooth, triangular and staircase waveform using DAC interface.
7. Display of 4-digit decimal number using the multiplexed 7-segment display interface.
8. Analog to digital conversion using internal ADC and display the result on LCD.
9. Digital to analog conversion using PWM (pulse delay to be implemented using timers).
10. Speed control of DC motor using PWM (pulse delay to be implemented using timers).
11. Interfacing of matrix keyboard (4X4).
12. Serial communication between microcontroller and PC.
Core course-XII
Electromagnetics
(Credits: Theory-04, Practicals-02)
Theory Lectures 60

Unit-1

Vector Analysis: Scalars and Vectors, Vector Algebra, Rectangular (Cartesian) Coordinate System, Vector Components and Unit Vector, Vector Field, Products, Cylindrical Coordinates, Spherical Coordinates, Differential Length, Area and Volume, Line Surface and Volume integrals, Del Operator, Gradient of a Scalar, Divergence and Curl of a Vector, the Laplacian.


Unit-2

Poisson’s Equation and Laplace’s Equation: Derivation of Poisson’s and Laplace’s equation, Uniqueness Theorem, Examples of Solution of Laplace’s Equation: Cartesian, Cylindrical and Spherical Coordinates.


Unit-3


Unit-4


Suggested Books:

**Electromagnetics Lab** (using Scilab/any other similar freeware)

**60 Lectures**

1. Understanding and Plotting Vectors.
2. Transformation of vectors into various coordinate systems.
3. 2D and 3D Graphical plotting with change of view and rotation.
4. Representation of the Gradient of a scalar field, Divergence and Curl of Vector Fields.
5. Plots of Electric field and Electric Potential due to charge distributions.
6. Plots of Magnetic Flux Density due to current carrying wire.
7. Programs and Contour Plots to illustrate Method of Images
8. Solutions of Poisson and Laplace Equations – contour plots of charge and potential distributions
Core course-XIII  
Communication Electronics  
(Credits: Theory-04, Practicals-02) 

Theory Lectures 60

Unit-1

Electronic communication: Block diagram of an electronic communication system, electromagnetic spectrum-band designations and applications, need for modulation, concept of channels and base-band signals. Concept of Noise, Types of Noise, Signal to noise ratio, Noise Figure, Noise Temperature, Friss formula.

Unit-2


Angle modulation: Frequency and Phase modulation, modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM (direct and indirect methods), FM detector (PLL). Block diagram of FM Transmitter and Receiver

Comparison between AM, FM and PM.

Unit-3

Pulse Analog Modulation: Channel capacity, Sampling theorem, PAM, PDM, PPM modulation and detection techniques, Multiplexing, TDM and FDM.

Pulse Code Modulation: Need for digital transmission, Quantizing, Uniform and Non-uniform Quantization, Quantization Noise, Companding, Coding, Decoding, Regeneration.

Unit-4

Digital Carrier Modulation Techniques: Block diagram of digital transmission and reception, Information capacity, Bit Rate, Baud Rate and M-ary coding. Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK)

Suggested Books:

1. Electronic communication systems- Kennedy, 3rd edition, McGraw international publications
Communication Electronics Lab (Hardware and Circuit Simulation Software)
60 Lectures

1. Study of Amplitude Modulation
2. Study of Amplitude Demodulation
3. Study of Frequency Modulation
4. Study of Frequency Demodulation
5. Study of Pulse Amplitude Modulation
6. AM Transmitter/Receiver
7. FM Transmitter/Receiver
8. Study of TDM, FDM
9. Study of Pulse Width Modulation
10. Study of Pulse Position Modulation
11. Study of Pulse Code Modulation
12. Study of Amplitude Shift Keying
13. Study of Phase Shift Keying,
Core course-XIV
Photonics
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1
(22 Lectures)

**Light as an Electromagnetic Wave:** Plane waves in homogeneous media, concept of spherical waves. Reflection and transmission at an interface, total internal reflection, Brewster’s Law. Interaction of electromagnetic waves with dielectrics: origin of refractive index, dispersion.

**Interference:** Superposition of waves of same frequency, Concept of coherence, Interference by division of wavefront, Young’s double slit, Division of Amplitude, thin film interference, anti-reflecting films, Newton’s rings; Michelson interferometer. Holography.

**Diffraction:** Huygen Fresnel Principle, Diffraction Integral, Fresnel and Fraunhoffer approximations. Fraunhofer Diffraction by a single slit, rectangular aperture, double slit, Resolving power of microscopes and telescopes; Diffraction grating: Resolving power and Dispersive power

Unit-2
(13 Lectures)

**Polarization:** Linear, circular and elliptical polarization, polarizer-analyzer and Malus’ law; Double refraction by crystals, Interference of polarized light, Wave propagation in uniaxial media. Half wave and quarter wave plates. Faraday rotation and electro-optic effect.

Unit-3
(13 Lectures)

**Light Emitting Diodes:** Construction, materials and operation.


**Photodetectors:** Bolometer, Photomultiplier tube, Charge Coupled Device. Photo transistors and Photodiodes (p-i-n, avalanche), quantum efficiency and responsivity.

**LCD Displays:** Types of liquid crystals, Principle of Liquid Crystal Displays, applications, advantages over LED displays.

Unit-4
(12 Lectures)

**Guided Waves and the Optical Fiber:** TE and TM modes in symmetric slab waveguides, effective index, field distributions, Dispersion relation and Group Velocity. Step index optical fiber, total internal reflection, concept of linearly polarized waves in the step index circular dielectric waveguides, single mode and multimode fibers, attenuation and dispersion in optical fiber.

**Suggested Books:**


Photonics Lab

60 Lectures
1. To verify the law of Malus for plane polarized light.
2. To determine wavelength of sodium light using Michelson’s Interferometer.
3. To determine wavelength of sodium light using Newton’s Rings.
4. To determine the resolving power and Dispersive power of Diffraction Grating.
5. Diffraction experiments using a laser.
7. Study of Electro-optic Effect.
8. To determine the specific rotation of scan sugar using polarimeter.
9. To determine characteristics of LEDs and Photo- detector.
10. To measure the numerical aperture of an optical fiber.
DSE-1
Control Systems
(Credits: Theory-04, Practicals-02)

Unit 1

Introduction to Control Systems: Open loop and Closed loop control systems, Mathematical modeling of physical systems (Electrical, Mechanical and Thermal), Derivation of transfer function, Armature controlled and field controlled DC servomotors, AC servomotors, block diagram representation & signal flow graph, Reduction Technique, Mason’s Gain Formula. Effect of feedback on control systems.

Unit 2

Time Domain Analysis: Time domain performance criteria, transient response of first, second & higher order systems, steady state errors and static error constants, Performance indices.

Concept of Stability: Asymptotic stability and conditional stability, Routh – Hurwitz criterion, relative stability analysis, Root Locus plots and their applications.

Unit 3

Frequency Domain Analysis: Correlation between time and frequency response, Polar and inverse polar plots, frequency domain specifications, Logarithmic plots (Bode Plots), gain and phase margins, Nyquist stability criterion, relative stability using Nyquist criterion, constant M & N circles.

Unit 4

State Space Analysis: Definitions of state, state variables, state space, representation of systems, Solution of time invariant, homogeneous state equation, state transition matrix and its properties.

Controllers and Compensation Techniques: Response with P, PI and PID Controllers, Concept of compensation, Lag, Lead and Lag-Lead networks

Suggested Books:

2. K. Ogata, Modern Control Engineering, PHI 2002
Control Systems Lab (Hardware and Scilab/MATLAB/Other Mathematical Simulation software)

60 Lectures

1. To study characteristics of:  
   a. Synchro transmitter receiver,  
   b. Synchro as an error detector
2. To study position control of DC motor
3. To study speed control of DC motor
4. To find characteristics of AC servo motor
5. To study time response of type 0, 1 and 2 systems
6. To study frequency response of first and second order systems
7. To study time response characteristics of a second order system.
8. To study effect of damping factor on performance of second order system
10. Study of P, PI and PID controller.
DSE-2
Electrical Machines
(Credits: Theory-04, Practicals-02)

Unit- 1
(20 Lectures)

DC Machines: Basic constructional features and physical principles involved in electrical machines, armature winding (ac and dc), lap and wave connections, different types of pitches

D.C. Generators: Construction and principles of operation, brief idea about armature reaction and commutation, E.M.F. Equation, Methods of excitation, and Characteristics of Self excited and separately (Shunt, Compound and Series) excited generators, Losses and efficiency, applications.

D.C. Motors: Comparison of generator and motor action & interchangeability, principle of operation, significance of back EMF, maximum power, Torque and speed relation, Characteristics of series, shunt and Compound excited motors & applications, losses & efficiency, necessity of motor starters, Three point starter, Speed control of DC motors, electronic speed control of DC motors, electric braking

Unit-2
(12 Lectures)

Transformers: Types of transformers, Transformer Construction, EMF equation, No load operation, operation under load, Phasor diagram, equivalent circuit of transformer, Transformer Losses, Voltage regulation, condition for maximum efficiency, All day efficiency, Short circuit and open circuit tests, Auto transformers.

Polyphase Circuits: Polyphase circuits, three phase transformers, delta-delta and delta –Y connection

Unit- 3
(16 Lectures)

Poly Phase Induction Motors: General constructional features, Types of rotors, Rotating magnetic field (Ferrari’s Principle), Induction motor as a generalized transformer, equivalent circuit, Production of torque, Slip, Torque equation, Torque-slip characteristics, Speed control of Induction motor. Comparison with DC motor


Unit- 4
(12 Lectures)

Synchronous Machines: Brief construction details of three phase synchronous generators, E.M.F. equation, Principle of operation of synchronous motor, methods of starting, factors for failure to start, applications, comparison of synchronous and induction motor

Suggested Books:

2. J.B. Gupta, Electrical Technology (Electrical Machines), Katsons
6. S. Ghose, Electrical Machines, Pearson Education
7. N. K. De and P. K. De, Electric Drives, Prentice Hall of India

Electrical Machines Lab

60 Lectures

1. Study of characteristics of DC Series motor.
2. Study of characteristics of DC Shunt motor.
5. Study of control of DC motor using SCR.
7. Study of Short Circuit Test on single phase transformer.
DSE-3
Power Electronics
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit- 1 (12 Lectures)

**Power Devices:** Need for semiconductor power devices, Power diodes, Enhancement of reverse blocking capacity, Introduction to family of thyristors.

**Silicon Controlled Rectifier (SCR):** structure, I-V characteristics, Turn-On and Turn-Off characteristics, ratings, Factors affecting the characteristics/ratings of SCR, Gate-triggering circuits, Control circuits design and Protection circuits, Snubber circuit.

Unit- 2 (14 Lectures)

**Diac and Triac:** Basic structure, working and V-I characteristic of, application of a Diac as a triggering device for a Triac.

**Insulated Gate Bipolar Transistors (IGBT):** Basic structure, I-V Characteristics, switching characteristics, device limitations and safe operating area (SOA) etc.

**Application of SCR:** SCR as a static switch, phase controlled rectification, single phase half wave, full wave and bridge rectifiers with inductive & non-inductive loads; AC voltage control using SCR and Triac as a switch.

**Power MOSFETs:** operation modes, switching characteristics, power BJT, second breakdown, saturation and quasi-saturation state.

Unit- 3 (17 Lectures)

**Power Inverters:** Need for commutating circuits and their various types, d.c. link invertors, Parallel capacitor commutated invertors with and without reactive feedback and its analysis, Series Inverter, limitations and its improved versions, bridge invertors.

**Choppers:** basic chopper circuit, types of choppers(Type A-D), step-down chopper, step-up chopper, operation of d.c. chopper circuits using self commutation (A & B-type commutating circuit), cathode pulse turn-off chopper(using class D commutation), load sensitive cathode pulse turn-off chopper (Jones Chopper), Morgan's chopper

Unit- 4 (17 Lectures)

**Electromechanical Machines:** DC Motors, Basic understanding of field and armature, Principle of operation, EMF equation, Back EMF, Factors controlling motor speed, Thyristor based speed control of dc motors, AC motor (Induction Motor only), Rotor and stator, torque & speed of induction motor, Thyristor control of ac motors(block diagrams only)

**Suggested Books:**

1. Power Electronics, P.C. Sen, TMH
2. Power Electronics & Controls, S.K. Dutta
3. Power Electronics, M.D. Singh & K.B. Khanchandani, TMH
7. Power Electronics, M.S. Jamil Asghar, PHI.

Power Electronics Lab
60 Lectures

1. Study of I-V characteristics of DIAC
2. Study of I-V characteristics of a TRIAC
3. Study of I-V characteristics of a SCR
4. SCR as a half wave and full wave rectifiers with R and RL loads
5. DC motor control using SCR.
6. DC motor control using TRIAC.
7. AC voltage controller using TRIAC with UJT triggering.
8. Study of parallel and bridge inverter.
9. Design of snubber circuit
10. VI Characteristic of MOSFET and IGBT (Both)
11. Study of chopper circuits
Numerical Techniques
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1
(16 Lectures)

Solution of Transcendental and Polynomial Equations \( f(x)=0 \): Bisection method, Secant and Regula Falsi Methods, Newton Raphson method, Rate of convergence, General Iteration Methods, Newton’s Method for Systems, Method for Complex Roots, Roots of Polynomial Equations.

Unit-2
(14 Lectures)

Interpolation and Polynomial Approximations: Taylor Series and Calculation of Functions, Langrange Interpolation, Newton Divided Difference Interpolation (forward and backward difference formulae), Truncation errors.
Curve Fitting: Least square fitting, Curve fitting, Interpolation by Spline functions.

Unit-3
(16 Lectures)

Numerical Integration: Trapezoidal Rule, Error bounds and estimate for the Trapezoidal rule, Simpson’s Rule, Error of Simpson’s rule.
Numerical Differentiation: Finite difference method and applications to electrostatic boundary value problems.

Unit- 4
(14 Lectures)

Matrix Eigenvalue: Power Method.

Suggested Books:


**Numerical Techniques Lab** (C language/ Scilab/MATLAB/Other Mathematical Simulation software)

**60 Lectures**

1. Program to implement Bisection Method
2. Program to implement Secant Method
3. Program to implement Regula falsi method
4. Program to implement Newton Raphson Method
5. Program to implement Trapezoidal rule
6. Program to implement Simpson’s rule
7. Program to implement Runge Kutta Method
8. Program to implement Euler-Cauchy Method
9. Program to implement Gauss-Jordon Method
10. Program to implement Gauss-Seidel Iteration
DSE-5
Basic VLSI Design
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit- 1 (15 Lectures)

Metal Oxide Semiconductor (MOS): Introduction to basic principle of MOS transistor, large signal MOS models (long channel) for digital design. MOS SPICE model, MOS device layout: Transistor layout, Inverter layout, CMOS digital circuit layout.

Unit- 2 (15 Lectures)

MOS Inverter: Inverter principle, Depletion and enhancement load inverters, the basic CMOS inverter, transfer characteristics, logic threshold, Noise margins, Dynamic behavior, Propagation Delay and Power Consumption.

Unit -3 (15 Lectures)

Combinational MOS Logic Design: Static MOS design, Pass Transistor logic, complex logic circuits. Sequential MOS Logic Design - Static latches, Flip flops & Registers, Dynamic Latches & Registers, CMOS Schmitt trigger, Monostable sequential Circuits, Astable Circuits.

Unit -4 (15 Lectures)

Memory Design: ROM & RAM cells design. Dynamic MOS design- Dynamic logic families and performances. Interconnect & Clock Distribution- Interconnect delays, Cross Talks, Clock Distribution.

Suggested Books:


Basic VLSI Design Lab
60 Lectures

1. To plot the (i) output characteristics & (ii) transfer characteristics of an n-channel and p-channel MOSFET.
2. To design and plot the static (VTC) and dynamic characteristics of a digital CMOS inverter.
3. To design and plot the output characteristics of a 3-inverter ring oscillator.
4. To design and plot the dynamic characteristics of 2-input NAND, NOR, XOR and XNOR logic gates using CMOS technology.
5. To design and plot the characteristics of a 4x1 digital multiplexer using pass transistor logic.
6. To design and plot the characteristics of a positive and negative latch based on multiplexers.
7. To design and plot the characteristics of a master-slave positive and negative edge triggered registers based on multiplexers.
DSE-6
Modern Communication Systems
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1

Advanced Digital Modulation Technique: DPCM, DM, ADM. Binary Line Coding Technique, Multi level coding, QAM (Modulation and Demodulation)

Unit-2

Optical Communication: Introduction of Optical Fiber, Types of Fiber, Guidance in Optical Fiber, Attenuation and Dispersion in Fiber, Optical Sources and Detectors, Block Diagram of optical communication system, optical power budgeting

Unit-3

Cellular Communication: Concept of cellular mobile communication – cell and cell splitting, frequency bands used in cellular communication, absolute RF channel numbers (ARFCN), frequency reuse, roaming and hand off, authentication of the SIM card of the subscribers, IMEI number, concept of data encryption, architecture (block diagram) of cellular mobile communication network, CDMA technology, CDMA overview, simplified block diagram of cellular phone handset, Comparative study of GSM and CDMA, 2G, 3G and 4G concepts.

Unit-4

Satellite communication: Introduction, need, satellite orbits, advantages and disadvantages of geostationary satellites. Satellite visibility, satellite system – space segment, block diagrams of satellite sub systems, up link, down link, cross link, transponders (C- Band), effect of solar eclipse, path loss, ground station, simplified block diagram of earth station. Satellite access, TDMA, FDMA, CDMA concepts, comparison of TDMA and FDMA, Satellite antenna (parabolic dish antenna), GPS-services like SPS & PPS.

Local area networks (LAN): Primary characteristics of Ethernet-mobile IP, OSI model, wireless LAN requirements-concept of Bluetooth, Wi-Fi and WiMAX.

Suggested Books:

Modern Communication Systems Lab

60 Lectures
1. Modulation of LED and detection through Photo detector.
2. Calculation of the transmission losses in an optical communication system.
3. Study of 16 QAM modulation and Detection with generation of Constellation Diagram
4. Study of DPCM and demodulation.
5. Study of DM, ADM
7. Study of Satellite Communication System.
8. Study of Optical Fiber Communication System
DSE-7
Semiconductor Fabrication and Characterization
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1

Introduciton of Semiconductor Process Technology (Line width – 10 nm technology), Semiconductor materials, single crystal, polycrystalline and amorphous, Crystal growth techniques: Si from the Czochralski technique, starting material, Distribution of dopants, Effective Segregation Coefficient. Silicon Float Zone Process, GaAs from Bridgman techniques. Wafer preparation.

Epitaxy Deposition: Epitaxial growth by vapor phase epitaxy (VPE) and molecular beam epitaxy (MBE).


Unit-2

Oxidation: Thermal Oxidation Process: Kinetics of Growth for thick and thin Oxide, Dry and Wet oxidation. Effects of high pressure and impurities, Impurity Redistribution during Oxidation, Masking property of Silicon Oxide, Oxide Quality. Chemical vapour deposition of silicon oxide, properties of silicon oxide, step coverage, P-glass flow.


Unit-3


Etching: Wet Chemical Etching-basic process and few examples of etchants for semiconductors, insulators and conductors; Dry etching using plasma etching technique.

Metallization: Uses of Physical Vapor Deposition and Chemical Vapor Deposition technique for Aluminum and Copper Metallization.

Unit-4


Suggested Books:


**Semiconductor Fabrication and Characterization Lab**  
**60 Lectures**

1. To measure the resistivity of semiconductor crystal with temperature by four –probe method.  
2. To determine the type (n or p) and mobility of semiconductor material using Hall-effect.  
3. Oxidation process Simulation  
4. Diffusion Process Simulation  
5. To design a pattern using photolithographic process and its simulation  
6. Process integration simulation  
7. Fabrication of thin film using Spin Coating/Thermal Coating System.  
8. Determination of Optical Bandgap through transmission spectra.
DSE-8
Digital Signal Processing
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit- 1 (15 Lectures)

Discrete Time systems: Discrete sequences, linear coefficient difference equation, Representation of DTS, LSI Systems. Stability and causality, frequency domain representations and Fourier transform of DT sequences.

Unit- 2 (15 Lectures)

Z-Transform: Definition and properties, Inverse Z Transform and stability. Parsevals Theorem and applications.

Unit- 3 (15 Lectures)

Discrete Fourier Transform: DFT assumptions and Inverse DFT. Matrix relations, relationship with FT and its inverse, circular convolution, DFT theorems, DCT. Computation of DFT. FFT Algorithms and processing gain, Discrimination, interpolation and extrapolation. Gibbs phenomena. FFT of real functions interleaving and resolution improvement. Word length effects.

Unit- 4 (15 Lectures)


Suggested Books:


Digital Signal Processing Lab (Scilab/MATLAB/Other Mathematical Simulation software)
60 Lectures

1. Generation of unit sample sequence, unit step, ramp function, discrete time sequence, real sinusoidal sequence.
2. Generate and plot sequences over an interval.
3. Given x[n], write program to find X[z].
4. Fourier Transform, Discrete Fourier Transform and Fast Fourier Transform
5. Design of a Butterworth analog filter for low pass and high pass.
DSE-9
Computer Networks
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit- I


Switching: Circuit switching (space-division, time division and space-time division), packet switching (virtual circuit and Datagram approach), message switching.

Unit-2

Data Link Layer: Design issues, Data Link Control and Protocols: Flow and Error Control, Stop-and-wait ARQ, Sliding window protocol, Go-Back-N ARQ, Selective Repeat ARQ, HDLC, Point-to –Point Access: PPP Point –to- Point Protocol, PPP Stack,

Medium Access Sub layer: Channel allocation problem, Controlled Access, Channelization, multiple access protocols, IEEE standard 802.3 & 802.11 for LANS and WLAN, high-speed LANs, Token ring, Token Bus, FDDI based LAN, Network Devices-repeaters, hubs, switches bridges.

Unit-3


Unit-4

Transport Layer: Process to Process Delivery: UDP; TCP, congestion control and Quality of service.

Application Layer: Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP), file transfer (FTP), HTTP and WWW.

Suggested Books:

1. Introduction to Computer Network laboratory
   Introduction to Discrete Event Simulation
   Discrete Event Simulation Tools - ns2/ns3, Omnet++

2. Using Free Open Source Software tools for network simulation of telnet and ftp between N sources - N sinks (N = 1, 2, 3). Evaluate the effect of increasing data rate on congestion.

3. Using Free Open Source Software tools for network simulation to study the effect of queuing disciplines on network performance - Random Early Detection/Weighted RED / Adaptive RED.

4. Using Free Open Source Software tools for network simulation for http, ftp and DBMS access in networks

5. Using Free Open Source Software tools for network simulation to study effect of VLAN on network performance - multiple VLANs and single router.

6. Using Free Open Source Software tools for network simulation to study effect of VLAN on network performance - multiple VLANs with separate multiple routers.

7. Using Free Open Source Software tools for network simulation to study the performance of wireless networks
DSE-10
Embedded Systems
(Credits: Theory-04, Practicals-02) Theory Lectures 60

Unit – 1 (10 Lectures)


Unit – 2 (17 Lectures)

AVR RISC Microcontrollers: Introduction to AVR RISC Microcontrollers, Architecture overview, status register, general purpose register file, memories, Instruction set, Data Transfer Instructions, Arithmetic and Logic Instructions, Branch Instructions, Bit and Bit-test Instructions, MCU Control Instructions. Simple programs in Assembly Language / C Language

Unit – 3 (17 Lectures)

Interrupts and Timer: Introduction to System Clock, Reset sources, Introduction to interrupts, External interrupts, IO Ports, 8-bit and 16-bit Timers, introduction to different modes, Input Capture and Compare Match.

Unit – 4 (16 Lectures)

Peripherals: Analog Comparator, Analog-to-Digital Converter, Serial Peripheral Interface (SPI), The Universal Synchronous and Asynchronous serial Receiver and Transmitter (USART), Two Wire Interface (TWI) / I^2C bus

Suggested Books:

1. AVR Microcontroller and Embedded Systems: Using Assembly and C by Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, PHI
2. Embedded system Design - Frank Vahid and Tony Givargis, John Wiley, 2002
3. Programming and Customizing the AVR Microcontroller by D V Gadre, McGraw-Hill
5. An Embedded Software Primer by David E Simon, Addison Wesley
Embedded Systems Lab (Experiments to be performed on AVR trainer kit)

60 Lectures

1. Flash LED at an observable rate.
2. Hello LED – Flash LED at a rate such that the LED appears always on. Estimate the onset of the rate when the LED appears to stay on.
3. Controlling ON/OFF of an LED using switch.
4. Use LFSR based random number generator to generate a random number and display it.
5. Toggle the LED every second using Timer interrupt.
6. Use the potentiometer to change the red LED intensity from 0 to maximum in 256 steps.
7. Use the switch to select the LED (from RGB led) and then the potentiometer to set the intensity of that LED and thus create your own color from amongst 16million colors.
8. Read the ADC value of the voltage divider involving the LDR. Print the value on the serial monitor.
9. Use the LDR and estimate a threshold for the LDR value and use that to turn the RGB LED on, to simulate an ‘automatic porch light’.
10. Use the thermistor to estimate the temperature and print the raw value on the serial monitor.
11. Connect the LCD I/O Board and print ‘Hello World’ on the LCD. Scroll display from left to right.
12. Use the on-board EEPROM to store the temperature min and max values together with a time stamp.
13. Speed control of d.c. motor.
14. Speed control of stepper motor.
DSE-11
Biomedical Instrumentation
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit 1 (17 Lectures)

**Biomedical signals & Physiological transducers:** Source of biomedical signal, Origin of bioelectric signals, recording electrodes, Electrodes for ECG, EMG & EEG. Physiological transducers: Pressure, Temperature, photoelectric & ultrasound Transducers. Measurement in Respiratory system: Physiology of respiratory system, Measurement of breathing mechanics Spirometer, Respiratory therapy equipments Inhalators ventilators & Respirators, Humidifiers, Nebulizers Aspirators, Biomedical recorders: ECG, EEG & EMG. MEMS based biosensors

Unit -2 (16 Lectures)

**Patient Monitoring systems & Audiometers:** Cardiac monitor, Bedside patient monitor, measurement of heart rate, blood pressure, temperature, respiration rate, Arrhythmia monitor, Methods of monitoring fatal heart rate, Monitoring labor activity. Audiometers: Audiometers, Blood cell counters, Oximeter, Blood flow meter, cardiac output measurement, Blood gas analyzers.

Unit- 3 (16 Lectures)

**Modern Imaging systems:** Introduction, Basic principle & Block diagram of x-ray machine, x-ray Computed Tomography (CT), Magnetic resonance imaging system (NMR), ultrasonic imaging system, Eco-Cardiograph, Eco Encephalography, Ophthalmic scans, MRI. Therapeutic Equipments: Cardiac pacemakers, cardiac defibrillators, Hemodialysis machine, surgical diathermy machine.

Unit -4 (11 Lectures)

**Patients safety & Computer Applications in Biomedical field:** Precaution, safety codes for electro medical equipment, Electric safety analyzer, Testing of biomedical equipment, Use of microprocessors in medical instruments, Microcontrollers, PC based medical instruments, Computerized Critical care units, Planning & designing a computerized critical care unit. **Physiotherapy:** Software Diathermy, microwave diathermy, Ultrasound therapy unit. Electrotherapy Equipments, Ventilators.

**Suggested Books:**

3. Khandpur R. S. - Handbook of Biomedical Instrumentation, TMH
5. Prof. S.K.VenkataRam-Bio-Medical Electronics and Instrumentation, Galgotia Publications
7. L. Cromwell et al - Biomedical Instrumentation and Measurements PHI

Biomedical Instrumentation Lab

60 Lectures

1. Characterization of bio potential amplifier for ECG signals.
2. Study on ECG simulator
3. Measurement of heart sound using electronic stethoscope. Study on ECG heart rate monitor/simulator
4. Study of pulse rate monitor with alarm system
5. Determination pulmonary function using spirometer (using mechanical system).
7. Study of Respiration Rate monitor/ apnea monitor
8. Study on ultrasound transducers based on medical system
10. Measurement of pulse rate using photoelectric transducer & pulse counting for known period.
DSE-12
Transmission Lines, Antenna and Wave Propagation
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1


Unit-2


Unit-3

Waveguides and Waveguide Devices: Wave propagation in waveguides, Parallel plate waveguides, TEM, TM and TE modes, Rectangular waveguides, circular waveguides, Power transmission and attenuation, Rectangular cavity resonators, directional couplers, isolator, circulator.

Unit-4

Radiation of electromagnetic waves: Concept of retarded potentials, Antenna Parameters: Radiation Mechanism, Current Distribution on a Thin Wire Antenna, Radiation Pattern, Radiation Power Density, Radiation Intensity, Beamwidth, Directivity, Antenna Efficiency, Gain, Beam Efficiency, Bandwidth, Polarization, Input Impedance Antenna Radiation Efficiency, Effective Length and Equivalent Areas, Maximum Directivity and Maximum Effective Area, Friis Transmission Equation and Radar Range Equation

Types of Antenna: Hertzian dipole, Half wave dipole, Quarter-wave dipole, Yagi-Uda, microstrip, Parabolic antenna, Helical antenna, Antenna array.

Suggested books:

2. Karl E. Longren, Sava V. Savov, Randy J. Jost., Fundamentals of Electromagnetics with MATLAB, PHI
Transmission Lines, Antenna and Wave Propagation Lab (Scilab/MATLAB/Other Mathematical Simulation Software)
60 Lectures

1. Program to determine the phasor of forward propagating field
2. Program to determine the instantaneous field of a plane wave
3. Program to find the Phase constant, Phase velocity, Electric Field Intensity and Intrinsic ratio
4. Program to find skin depth, loss tangent and phase velocity
5. Program to determine the total voltage as a function of time and position in a loss less transmission line
6. Program to find the characteristic impedance, the phase constant an the phase velocity
7. Program to find the output power and attenuation coefficient
8. Program to find the power dissipated in the lossless transmission line
9. Program to find the total loss in lossy lines
10. Program to find the load impedance of a slotted line
11. Program to find the input impedance for a line terminated with pure capacitive impedance
12. Program to determine the operating range of frequency for TE10 mode of air filled rectangular waveguide
13. Program to determine Directivity, Bandwidth, Beamwidth of an antenna
14. Program to determine diameter of parabolic reflector
15. Program to find out minimum distance between primary and secondary antenna
SEC
Design and Fabrication of Printed Circuit Boards
(Credits: 02)
Total Lectures 60

PCB Fundamentals: PCB Advantages, components of PCB, Electronic components, Microprocessors and Microcontrollers, IC’s, Surface Mount Devices (SMD). Classification of PCB - single, double, multilayer and flexible boards, Manufacturing of PCB, PCB standards.

Schematic & Layout Design: Schematic diagram, General, Mechanical and Electrical design considerations, Placing and Mounting of components, Conductor spacing, routing guidelines, heat sinks and package density, Net list, creating components for library, Tracks, Pads, Vias, power plane, grounding.

Technology OF PCB: Design automation, Design Rule Checking; Exporting Drill and Gerber Files; Drills; Footprints and Libraries Adding and Editing Pins, copper clad laminates materials of copper clad laminates, properties of laminates (electrical & physical), types of laminates, soldering techniques. Film master preparation, Image transfer, photo printing, Screen Printing, Plating techniques etching techniques, Mechanical Machining operations, Lead cutting and Soldering Techniques, Testing and quality controls.

PCB Technology: Trends, Environmental concerns in PCB industry.

Suggested Books:

Programming Environments: Integrated Development Environment (IDE) for AVR microcontrollers, free IDEs like AVR Studio, WIN AVR. Installing and configuring for Robot programming, In System Programmer (ISP), loading programmes on Robot.

Actuators: DC Motors, Gearing and Efficiency, Servo Motors, Stepper motors, Motor Control and its implementations.

Sensors: White line sensors, IR range sensor of different range, Analog IR proximity sensors, Analog directional light intensity sensors, Position encoders, Servo mounted sensor pod/Camera Pod, Wireless colour camera, Ultrasound scanner, Gyroscope and Accelerometer, Magnetometer, GPS receiver, Battery voltage sensing, Current Sensing.

LCD interfacing with the robot (2 x 16 Characters LCD).

Other indicators: Indicator LEDs, Buzzer.

Timer / Counter operations: PWM generation, Motor velocity control, Servo control, velocity calculation and motor position control, event scheduling.


Suggested Books:
Introduction: What is mobile Application Programming, Different Platforms, Architecture and working of Android, iOS and Windows phone 8 operating system, Comparison of Android, iOS and Windows phone 8.


Views and Layouts, Buttons, Menus, and Dialogs, Graphics Resources in Android: Introducing the Drawables, Implementing Images, Core Drawable Subclasses, Using Bitmap, PNG, JPEG and GIF Images in Android, Creating Animation in Android

Handling User Interface(UI) Events: An Overview of UI Events in Android, Listening for and Handling Events, Handling UI Events via the View Class, Event Callback Methods, Handling Click Events, Touchscreen Events, Keyboard Events, Context Menus, Controlling the Focus.

Content Providers: An Overview of Android Content Providers, Defining a Content Provider, Working with a Database.

Intents and Intent Filters: Intent, Implicit Intents and Explicit Intents, Intents with Activities, Intents with Broadcast Receivers


iOS Development Environment: Overview of iOS, iOS Layers, Introduction to iOS application development.

Windows phone Environment: Overview of windows phone and its platform, Building windows phone application.

Suggested Books:
1. Beginning Android 4, Onur Cinar, Apress Publication
2. Professional Android 4 Application Development, Reto Meier, Wrox
3. Beginning iOS 6 Development: Exploring the iOS SDK, David Mark, Apress
5. Professional Windows 8 Programming: Application Development with C# and XML, Allen Sanders and Kevin Ashley, Wrox Publication
SEC
Internet and Java Programming
(Credits: 02)
Total Lectures 60

**Internet:** Introduction, Understanding the Internet, Internet Addressing, Hardware Requirements to Connect to the Internet.

**Data types, Arrays, Operators, Flow control:** Branching, Looping, Classes, New Operator, Dot Operator, Method Declaration and Calling, Constructors, Inheritance, Super, Method Overriding Final, Finalize, Static, Package and Import Statement, Interface and Implements

**Exception Handling:** Exception Types, Uncaught and Calling, Nested Try Statements, Java Thread Model, and Thread, Runnable, Thread Priorities, Synchronization, Deadlock

**File:** Input Stream, Output Stream, and File Stream. Applets-Tag, Order of Applet Initialization, Repainting, Sizing Graphics- Abstract Window Tool Kit Components

**Suggested Books:**

Introduction to Virtual Instrumentation: Computers in Instrumentation, concept of Virtual Instrumentation (VI), History of VI, LabVIEW and VI, Conventional and Graphical Programming, Distributed Systems


Basics of Data Acquisition: Classification of Signals, Real-World Signals, Analog Interfacing, Connecting the Signal to the Board, Practical vs. Ideal Interfacing, Bridge Signal Sources.

Data Acquisition with LabVIEW: Measurement and Automation Explorer, Waveform Data Type, Working in DAQmx, Working in NI-DAQ, Use of Simple analog and digital Vis, Continuous data acquisition, acquisition of data in bursts, DAQ Assistant, Analysis Assistant, Instrument Assistant, Instrument Interfacing and LabVIEW, Data Sockets.

Suggested Books:

GE
Electronic Circuits and PCB Designing
(Credits: Theory-04, Practicals-02)

Total Lectures 60

Unit-1

Network theorems (DC analysis only): Review of Ohms law, Kirchhoff’s laws, voltage divider and current divider theorems, open and short circuits. Thevenin’s theorem, Norton’s theorem and interconversion, superposition theorem, maximum power transfer theorem.

Unit 2


Unit-3


Unit-4


**Suggested Books:**

2. Electronics text lab manual, Paul B. Zbar.
4. Basic Electronics and Linear circuits, N.N. Bhargava, D.C. Kulshresta and D.C Gupta -TMH.

**Electronic Circuits and PCB Designing Lab (Hardware and Circuit Simulation Software)**

60 lectures

1. Verification of Thevenin’s theorem
2. Verification of Super position theorem
3. Verification of Maximum power transfer theorem.
5. Centre tapped full wave rectifier – without and with shunt capacitance filter.
7. Transistor characteristics in CE mode – determination of ri, ro and β.
8. Design and study of voltage divider biasing.
9. Designing of an CE based amplifier of given gain
10. Designing of PCB using artwork, its fabrication and testing.
11. Design, fabrication and testing of a 9 V power supply with zener regulator
GE
Digital System Design
(Credits: Theory-04, Practicals-02)

Total Lectures 60

Unit-1
(15 lectures)

**Number System and Codes:** Decimal, Binary, Hexadecimal, Octal, BCD, Conversions, Complements (1’s and 2’s), Signed and unsigned numbers, addition and subtraction, multiplication and subtraction, Gray Codes


Unit-2
(11 lectures)

**Combinational logic analysis and design:** Multiplexers and Demultiplexers, Adder (half and full) and their use as subtractor, Encoder and Decoder, Code Converter (Binary to BCD and vice versa)

Unit-3
(16 lectures)

**Sequential logic design:**Latch, Flip flop, S-R FF , J-K FF, T and D type FFs, clocked FFs, registers, Counters (ripple, synchronous and asynchronous, ring, modulus)

Unit-4
(18 Lectures)

**VHDL:** A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and Verilog, Introduction to Simulation and Synthesis Tools, Test Benches.

VHDL: Module, Delays, brief description - data flow style, behavioral style, structural style, mixed design style, simulating design.

Language Elements, Introduction, Keywords, Identifiers, White Space Characters, Comments, format, Integers, reals and strings. Logic Values, Data Types-net types, undeclared nets, scalars and vector nets, Register type, Parameters. Operands, Operators, types of Expressions

Gate level modeling, built in Primitive Gates, multiple input gates, Tri-state gates, pull gates, MOS switches, bidirectional switches, gate delay, array instances, implicit nets, Illustrative Examples (both combinational and sequential logic circuits).

**Suggested books:**

**Digital System Design Lab (Hardware and Circuit Simulation Software)**
60 lectures
1. To verify and design AND, OR, NOT and XOR gates using NAND gates.
2. To convert a Boolean expression into logic gate circuit and assemble it using logic gate IC’s.
3. Design a Half and Full Adder.
4. Design a Half and Full Subtractor.
5. Design a seven segment display driver.
6. Design a 4 X 1 Multiplexer using gates.
7. To build a Flip- Flop Circuits using elementary gates. (RS, Clocked RS, D-type).
9. Design a shift register and study Serial and parallel shifting of data.

**VHDL**
1. Write code to realize basic and derived logic gates.
2. Half adder, Full Adder using basic and derived gates.
3. Half subtractor and Full Subtractor using basic and derived gates.
4. Clocked D FF, T FF and JK FF (with Reset inputs).
5. Multiplexer (4x1, 8x1) and Demultiplexer using logic gates.
6. Decoder (2x4, 3x8), Encoders and Priority Encoders.
7. Design and simulation of a 4 bit Adder.
8. Code converters (Binary to Gray and vice versa).
9. 2 bit Magnitude comparator.
10. 3 bit Ripple counter.
**GE**

**Instrumentation**
*(Credits: Theory-04, Practicals-02)*

Total Lectures 60

**Unit-1**
(10 Lectures)

**DC and AC indicating Instruments:** Accuracy and precision, Types of errors, PMMC galvanometer, sensitivity, Loading effect, Conversion of Galvanometer into ammeter, Voltmeter and Shunt type ohmmeter, Multimeter.

**Unit- 2**
(18 Lectures)

**Oscilloscopes:** CRT, wave form display and electrostatic focusing, time base and sweep synchronisation, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Dual trace oscilloscope, Sampling Oscilloscope, DSO and Powerscope: Block diagram, principle and working, Advantages and applications, CRO specifications (bandwidth, sensitivity, rise time).

**Signal Generators:** Audio oscillator, Pulse Generator, Function generators.

**Unit - 3**
(12 Lectures)

**Transducers:** Basic requirements of transducers, Transducers for measurement of non-electrical quantities: Types and their principle of working, measurement of Linear displacement, Acceleration, Flow rate, Liquid level, strain, Force, Pressure, Temperature.

**Unit - 4**
(20 Lectures)

**Data acquisition systems:** Block diagram, brief description of preamplifier, signal conditioner, instrumentation amplifier, waveform generator, A/D and D/A converter blocks, computer controlled test and measurement system.


**Suggested Books:**

1. Electrical Measurement in Measuring Instruments. Goldwing E.W. and Widdies
2. Electrical and Electronics Measurement and Instrumentation Sahwany A.K.
3. Instrumentation devices and systems: Rangan, Sarma, Mani, TMH
4. Instrumentation measurement and analysis: Nakra B C, Chaudry K K, TMH
5. Handbook of biomedical instrumentation: Khandpur R S, TMH
Instrumentation Lab
60 Lectures
1. Design of multi range ammeter and voltmeter using galvanometer.
2. To determine the Characteristics of resistance transducer - Strain Gauge (Measurement of Strain using half and full bridge.)
3. To determine the Characteristics of LVDT.
4. To determine the Characteristics of Thermistors and RTD.
5. Measurement of temperature by Thermocouples and study of transducers like AD590 (two terminal temperature sensor), PT-100, J-type, K-type.
6. Characterization of bio potential amplifier for ECG signals.
7. Study on ECG simulator
8. Measurement of heart sound using electronic stethoscope. Study on ECG heart rate monitor /simulator
9. Study of pulse rate monitor with alarm system
10. Measurement of respiration rate using thermister /other electrodes.
GE
Practical Electronics
(Credits: Theory-04, Practicals-02)

Total Lectures 60

Unit-1

Timer and PLL: Functional block diagram of 555 timer, Monostable operation and its Application, Astable operation and its Applications,
Phase Locked Loop: Functional block diagram – Phase detector / Comparator, Voltage Controlled Oscillator, Low pass filter, Applications: Frequency multiplier/ Division, AM detection

Unit-2

First order active filters (Circuit diagram and formula only): low pass, high pass, band pass, band reject and all pass filters.
Phase-shift & Wein bridge oscillator using op-amp.

Unit-3

Transducers (Basic Working): Displacement transducers - Resistive (Potentiometric, Strain Gauges – Types, Gauge Factor, bridge circuits, Semi-conductor strain gauge) Capacitive (diaphragm), Hall effect sensors, magneto-strictive transducers, Microphone, Touch Switch, Piezoelectric sensors, light( photo-conductive, photo emissive, photo voltaic, semiconductor, LDR), Temperature( electrical and non-electrical), Pressure sensor.

A-D and D-A Conversion: D-A conversion: 4 bit binary weighted resistor type, circuit and working. Circuit of R-2R ladder- Basic concept. A-D conversion characteristics, successive approximation ADC. (Mention the relevant ICs for all).

Unit-4


Suggested Books:

2. Electrical Measurements & Electronic Measurements by A.K. Sawhney
3. Instrumentation- Devices and Systems By Rangan, Sarma, and Mani, Tata-McGraw Hill
Practical Electronics Lab (Hardware and Circuit Simulation Software)
60 Lectures

1. Study of basic monostable multivibrator
2. Study of basic astable multivibrator
3. Light detection using 555 timer
4. Rain alarm using 555 timer
5. Motor control by PWM using 555 timer
6. LED flasher circuit using 555 timer
7. Analog lightwave Transmitter/Receiver using 555 timer
8. Study of basic inverting and non-inverting amplifier
9. Study of basic integrator circuit
10. Study of basic differentiator circuit
11. Design of first order LPF
12. Study of first order HPF
14. Temperature to voltage converter using 741.
15. Shadow sensing using 741
16. Light based PWM using 741 and V-F converter
17. Test the different Arduino Boards, Open-Source and Arduino Shields.
18. Install Arduino IDE and its development tool.
19. Develop a program to Blink LED for 1 second.
20. Develop a program to interface Input Switches and output LEDs with development board (arduino).
21. Interface 7 segment display with development board (arduino)
22. Interface LM35 temperature sensor with arduino and monitor temperature on serial monitor.
24. Interfacing of various sensors with arduino development board
GE
Communication Systems
(Credits: Theory-04, Practicals-02)

Total Lectures 60

Unit-1
(16 Lectures)

Noise and Transmission lines: Noise-Introduction, internal and external noises, signal to noise ratio and noise figure

Amplitude Modulation/demodulation techniques: Block diagram of electronic communication system. Modulation-need and types of modulation-AM, FM & PM.
Amplitude modulation – representation, modulation index, expression for instantaneous voltage, power relations, frequency spectrum, DSBFC, DSBSC and SSBSC (mention only).
Limitations of AM.
Demodulation- AM detection: principles of detection, linear diode, principle of working and waveforms.
Block diagram of AM transmitter and Receiver.

Unit-2
(12 Lectures)

Frequency Modulation/demodulation techniques: Frequency Modulation: definition, modulation index, FM frequency spectrum diagram, bandwidth requirements, frequency deviation and carrier swing, FM generator-varactor diode modulator.
FM detector – principle, slope detector-circuit, principle of working and waveforms.
Block diagram of FM transmitter and Receiver. Comparison of AM and FM.

Unit-3
(16 Lectures)

Digital communication: Introduction to pulse and digital communications, digital radio, sampling theorem, types- PAM, PWM, PPM, PCM – quantization, advantages and applications, digital modulations (FSK, PSK, and ASK). Advantage and disadvantages of digital transmission, characteristics of data transmission circuits – Shannon limit for information capacity, bandwidth requirements, data transmission speed, noise, cross talk, echo suppressors, distortion and equalizer, MODEM- modes, classification, interfacing (RS232). TDMA, FDMA, CDMA concepts, comparison of TDMA and FDMA.

Unit-4
(16 Lectures)

Cellular Communication: Concept of cellular mobile communication – cell and cell splitting, frequency bands used in cellular communication, absolute RF channel numbers (ARFCN), frequency reuse, roaming and hand off, authentication of the SIM card of the subscribers, IMEI number, concept of data encryption, architecture (block diagram) of cellular mobile communication network, CDMA technology, CDMA overview, simplified block diagram of cellular phone handset, Comparative study of GSM and CDMA, 2G, 3G and 4G concepts.
Satellite communication: Introduction, to Orbit, types of orbits, Block diagram of satellite transponder.

Suggested Books:
1. Electronic Communication, George Kennedy, 3rd edition, TMH.
2. Electronic Communication, Roddy and Coolen, 4th edition, PHI.

Communication Systems Lab
60 Lectures

1. Amplitude modulator and Amplitude demodulator
2. Study of FM modulator using IC8038
3. Study of VCO using IC 566
4. Study of Time Division Multiplexing and de multiplexing
5. Study of AM Transmitter/Receiver
6. Study of FM Transmitter/Receiver
7. ASK modulator and demodulator
8. Study of FSK modulation
9. Study of PWM and PPM
10. Study of PAM modulator and demodulator
GE
Microprocessor and Microcontroller System
(Credits: Theory-04, Practicals-02)

Total Lectures 60

Unit-1  
(10 Lectures)

**Number systems:** Binary, hexadecimal – conversion from binary to decimal and vice-versa, binary to hexadecimal and vice-versa, decimal to hexadecimal and vice versa, addition and subtraction of binary numbers and hexadecimal numbers. Subtraction using 2’s complement, signed number arithmetic.

**Introduction to Microprocessor:** Introduction, applications, basic block diagram, speed, word size, memory capacity, classification of microprocessors (mention different microprocessors being used)

**Microprocessor 8085:** Features, architecture -block diagram, internal registers, register pairs, flags, stack pointer, program counter, types of buses. Multiplexed address and data bus, generation of control signals, pin description of microprocessor 8085.

Unit-2  
(18 Lectures)

**8085 Instructions:** Operation code, Operand & Mnemonics. Instruction set of 8085, instruction classification, addressing modes, instruction format. Data transfer instructions, arithmetic instructions, increment & decrement instructions, logical instructions, branch instructions and machine control instructions. Stack operations, subroutine calls and return operations. Delay loops, use of counters, timing diagrams-instruction cycle, machine cycle, T- states, time delay. Interrupt structure of 8085A microprocessor, processing of vectored and non-vectored interrupts, latency time and response time. Interfacing of memory chips, address allocation technique and decoding; Interfacing of I/O devices, LEDs and toggle-switches as examples, memory mapped and isolated I/O structure; Input/output techniques: CPU initiated unconditional and conditional I/O transfer.

Unit-3  
(12 Lectures)

**Introduction to Microcontrollers:** Basic block diagram, comparison of microcontroller with microprocessors, comparison of 8 bit, 16 bit and 32 bit microcontrollers. MICROCONTROLLER 8051- architecture -internal block diagram, key features of 8051, pin diagram, memory organization, Internal RAM memory, Internal ROM. General purpose data memory, special purpose/function registers, external memory. **Counters and timers:** 8051 oscillator and clock, program counter, TCON, TMOD, timer counter interrupts, timer modes of operation. Input / output ports and circuits/ configurations, serial data input / output – SCON, PCON, serial data transmission modes.

Unit-4  
(20 Lectures)
8051 Interrupts, Addressing modes and Instruction set: Interrupts – IE, IP, time flag interrupts, serial port interrupt, external interrupts, reset, interrupt control, interrupt priority, interrupt destinations & software generated interrupts. Addressing modes, immediate addressing, register addressing, direct and indirect addressing. Data transfer instructions, internal data move, external data move, code memory read-only data move, Push and Pop and data exchange instructions. Logical Instructions, byte level logical operations, bit level logical operations, rotate and swap operations. Arithmetic Instructions, flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic, simple programs in assembly language. Timer / Counter Programming in 8051: Programming 8051 timers, counter programming, programming timers 0 and 1 in 8051 C

Suggested Books:


Microprocessor and Microcontroller System Lab
60 Lectures

1. Program to transfer a block of data.
2. Program for multibyte addition
3. Program for multibyte subtraction
4. Program to multiply two 8-bit numbers.
5. Program to divide a 16 bit number by 8 bit number.
6. Program to search a given number in a given list.
7. Program to generate terms of Fibonacci series.
8. Program to sort numbers in ascending/descending order.
9. Program to find the square root of an integer.
10. To study interfacing of IC 8255.
11. Program to verify the truth table of logic gates.

8051 Microcontroller Programming

1. Program to find the sum of N 8-bit numbers.
2. Program to find largest of N numbers.
3. Program to find smallest of N numbers
4. Program to find whether the given data is palindrome.
5. Program to arrange the numbers in ascending order.
6. Interfacing of stepper motor and Rotating stepper motor by N steps clockwise/ anticlockwise with speed control.
7. LCD interfacing.
8. Speed control of DC motor using PWM (pulse delay to be implemented using timers).
GE
Consumer Electronics
(Credits: Theory-04, Practicals-02)

Total Lectures 60

Unit -1 (10 Lectures)

**Audio systems:** PA system, Microphone, Amplifier, Loudspeakers. Radio receivers, AM/FM. Audio recording and reproduction, Cassettes, CD and MP3.

Unit-2 (16 Lectures)

**TV and Video systems:** Television standards, BW/Colour, CRT/HDTV. Video system, VCR/VCD/DVD players, MP4 players, Set Top box, CATV and Dish TV, LCD, Plasma & LED TV. Projectors: DLP, Home Theatres, Remote Controls

Unit-3 (17 Lectures)

**Landline and Mobile telephony:** Basic landline equipment, CLI, Cordless. Intercom/EPABX system. Mobile phones: GPRS & Bluetooth. GPS Navigation system. Smart Phones

**Office Equipment:** Scanners, Barcode / Flat bed, Printers, Xerox, Multifunction units (Print, Scan, fax, and copy)

Unit-4 (17 Lectures)

**Electronic Gadgets and Domestic Appliances:** Digital clock, Digital camera, Handicam, Home security system, CCTV. Air conditioners, Refrigerators, Washing Machine/Dish Washer, Microwave oven, Vacuum cleaners

**Suggested Books:**

**Consumer Electronics Lab**

60 Lectures

1. Study of PA systems for various situations – Public gathering, closed theatre/Auditorium, Conference room, Prepare Bill of Material (Costing)
2. Installation of Audio/Video systems – site preparation, electrical requirements, cables and connectors
3. Market Survey of Products (at least one from each module)
4. Identification of block and tracing the system. Assembly and Disassembly of system using Toolkit