Syllabus

CHOICE BASED CREDIT SYSTEM

B. Sc. (HONOURS) Electronic Science

UNIVERSITY OF BURD WAN
# Course Structure
*(Electronic Science-Major)*

**Details of course under B.Sc. (Honours)**

<table>
<thead>
<tr>
<th>Course</th>
<th><em>Credits</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory+ Practical</td>
</tr>
<tr>
<td>=================================================================</td>
<td></td>
</tr>
<tr>
<td><strong>I. Core Course</strong></td>
<td>14X4= 56</td>
</tr>
<tr>
<td>(14 Papers)</td>
<td></td>
</tr>
<tr>
<td>Core Course Practical / Tutorial*</td>
<td>14X2=28</td>
</tr>
<tr>
<td>(14 Papers)</td>
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<tr>
<td><strong>II. Elective Course</strong></td>
<td></td>
</tr>
<tr>
<td>(8 Papers)</td>
<td></td>
</tr>
<tr>
<td>A.1. Discipline Specific Elective</td>
<td>4X4=16</td>
</tr>
<tr>
<td>(4 Papers)</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>Practical/ Tutorial*</td>
<td></td>
</tr>
<tr>
<td>(4 Papers)</td>
<td></td>
</tr>
<tr>
<td>B.1. Generic Elective/ Interdisciplinary</td>
<td>4X4=16</td>
</tr>
<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>Practical/ Tutorial*</td>
<td></td>
</tr>
<tr>
<td>(4 Papers)</td>
<td></td>
</tr>
<tr>
<td><strong>III. Ability Enhancement Courses</strong></td>
<td></td>
</tr>
<tr>
<td>1. Ability Enhancement Compulsory Courses (AECC)</td>
<td></td>
</tr>
<tr>
<td>(2 Papers)</td>
<td></td>
</tr>
<tr>
<td>Environmental Studies</td>
<td>4x1=4</td>
</tr>
<tr>
<td>English/MIL Communication</td>
<td>2x1=2</td>
</tr>
<tr>
<td>2. Skill Enhancement Courses (SEC)</td>
<td></td>
</tr>
<tr>
<td>(Minimum 2)</td>
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<tr>
<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><strong>Total credit</strong></td>
<td><strong>142</strong></td>
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## Scheme for Choice Based Credit System in B.Sc.(Honours) Electronic Science

<table>
<thead>
<tr>
<th>I</th>
<th>Basic Circuit Theory and Network Analysis</th>
<th>Environmental Studies</th>
<th>Elective: Generic (GE) (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>Semiconductor Devices, Applied Physics (English/MIL Communication)</td>
<td>Elective: Specific DSE (4)</td>
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</tr>
<tr>
<td>III</td>
<td>Electronic Circuits, Digital Electronics and Verilog, C Programming and Data Structures</td>
<td>SEC-1</td>
<td>GE-3</td>
</tr>
<tr>
<td>IV</td>
<td>Operational Amplifiers and Applications, Signals and Systems, Electronic Instrumentation</td>
<td>SEC-2</td>
<td>GE-4</td>
</tr>
<tr>
<td>V</td>
<td>Microprocessors and Microcontrollers, Electromagnetics</td>
<td>DSE-1</td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>Communication Electronics, Photonics</td>
<td>DSE-2</td>
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### CORE COURSE (14)

- Ability Enhancement Compulsory Course (AECC) (2)
- Skill Enhancement Course (SEC) (2)
- Elective: Discipline Specific DSE (4)
- Elective: Generic (GE) (4)
<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Opted</th>
<th>Course Name</th>
<th>Credits</th>
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<tr>
<td>I</td>
<td>Ability Enhancement Compulsory Course-I</td>
<td>Environmental Studies</td>
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<td>Core course-I</td>
<td>Basic Circuit Theory and Network Analysis</td>
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<td>Core Course-I Practical/Tutorial</td>
<td>Basic Circuit Theory and Network Analysis Lab</td>
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<td>Mathematics Foundation for Electronics</td>
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<td>Core Course-II Practical</td>
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<td>Generic Elective -1</td>
<td>GE-1</td>
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<td>Semiconductor Devices</td>
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<td>Applied Physics</td>
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<td>Core Course-IV Practical</td>
<td>Applied Physics Lab</td>
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<td>Generic Elective -2</td>
<td>GE-2</td>
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<td>Generic Elective -2 Practical</td>
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<td>III</td>
<td>Core course-V</td>
<td>Electronic Circuits</td>
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<td>Digital Electronics and VHDL</td>
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<td>Core Course-VI Practical</td>
<td>Digital Electronics and VHDL Lab</td>
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<td>Core course-VII</td>
<td>C Programming and Data Structures</td>
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<td>Core Course-VII Practical</td>
<td>C Programming and Data Structures Lab</td>
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<td>Skill Enhancement Course-1</td>
<td>SEC-1</td>
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<td>Generic Elective -3</td>
<td>GE-3</td>
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<td>Core course-VIII</td>
<td>Operational Amplifiers and Applications</td>
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<td>Operational Amplifiers and Applications Lab</td>
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<td>Core course-IX</td>
<td>Signals and Systems</td>
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<td>Signals and Systems Lab</td>
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<td>Core course-X</td>
<td>Electronic Instrumentation</td>
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<td>Electronic Instrumentation Lab</td>
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<td>Skill Enhancement Course-2</td>
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<td>Generic Elective -4</td>
<td>GE-4</td>
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<tr>
<td>Semester</td>
<td>Core Course</td>
<td>Discipline Specific Electives</td>
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<tr>
<td>V</td>
<td>Core course-XI</td>
<td>Microprocessors and Microcontrollers 4</td>
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<td>Core Course-XI Practical</td>
<td>Microprocessors and Microcontrollers Lab 2</td>
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<td>Core course-XII</td>
<td>Electromagnetics 4</td>
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<td>Core Course-XII Practical</td>
<td>Electromagnetics Lab 2</td>
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<td>Discipline Specific Elective-1</td>
<td>DSE-1 4</td>
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<td>Discipline Specific Elective-1 Practical/Tutorial</td>
<td>DSE-1 Lab 2</td>
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<tr>
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<td>Discipline Specific Elective-2</td>
<td>DSE-2 4</td>
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<td>Discipline Specific Elective-2 Practical</td>
<td>DSE-2 Lab 2</td>
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<tr>
<td>VI</td>
<td>Core course-XIII</td>
<td>Communication Electronics 4</td>
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<td>Core Course-XIII Practical/Tutorial</td>
<td>Communication Electronics Lab 2</td>
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<td>Core course-XIV</td>
<td>Photonics 4</td>
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<td>Core Course-XIV Practical/Tutorial</td>
<td>Photonics Lab 2</td>
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<td>Discipline Specific Elective-3</td>
<td>DSE-3 4</td>
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<td>Discipline Specific Elective-3 Practical/Tutorial</td>
<td>DSE-3 Lab 2</td>
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<td>Discipline Specific Elective-4</td>
<td>DSE-4 4</td>
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<td>Discipline Specific Elective-4 Practical</td>
<td>DSE-4 Lab 2</td>
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</table>

**Total Credits 142**

1 credit = 1 hour/week for theory; 2 hours/week for practical

**CORE COURSE (CC): (Credit: 06 each)** (1 period/week for tutorials or 4 periods/week for practical)

1. Basic Circuit Theory and Network Analysis
2. Mathematics Foundation for Electronics
3. Semiconductor Devices
4. Applied Physics
5. Electronic Circuits
6. Digital Electronics and Verilog
7. C Programming and Data Structures
8. Operational Amplifiers and Applications
9. Signals and Systems
10. Electronic Instrumentation
11. Microprocessors and Microcontrollers
12. Electromagnetics
13. Communication Electronics
14. Photonics

**Discipline Specific Electives (DSE): (Credit: 06 each): 4 courses to be selected, 2 courses for Semester-V and 2 courses for Semester-VI**

Semester-V

DSE-1
Basic VLSI Design
or
Transmission Lines, Antenna and Wave Propagation
DSE-2
Control Systems

Semester-VI
DSE-3
Modern Communication Systems
or
Numerical Analysis
DSE-4
Digital Signal Processing
or
Dissertation

Other Discipline (Exactly two papers from strictly two disciplines) – GE 1 to GE 4
1. Mathematics
2. Chemistry
3. Physics
4. Computer Science

Skill Enhancement Course (SEC) (02 papers) (Credit: 02 each) - SEC1 and SEC2
Semester-III: SEC-1
Semester-IV: SEC-2
1. Design and Fabrication of Printed Circuit Boards
2. Robotics

Generic Elective Papers (GE) (minor-Electronic Science) (any four) for honours candidates of other Departments/Disciplines: (Credit: 06 each)
1. Electronic Circuits and PCB Designing
2. Practical Electronics
3. Digital System Design
4. Communication Systems

For Papers having practical, distribution of 75 marks be as follows:
i) Class Attendance cum Internal Assessment: 20% of 75 marks = 15 marks of which 5 marks be reserved for theoretical class attendance in the following manner:
   Attendance 50% & above but below 60% - 2 marks
   Attendance 60% & above but below 75% - 3 marks
   Attendance 75% & above but below 90% - 4 marks
   Attendance 90% & above - 5 marks
   and 10 marks be reserved for class test/assignment/seminar (theoretical-5 & practical-5).

ii) 20 marks be allotted for Semester-end Practical Examination of each paper, distribution of which may be as under:
   a) Lab. Note Book : 05 Marks
   b) Viva-voce : 05 Marks
   c) Experiment : 10 marks
iii) 40 marks be allotted for Semester-end-Theoretical Examination of each paper (Duration of Exam : 2 hours), distribution of which may be as under:

a) Answer 05 questions out of 08 carrying 02 marks each  = 5x02 = 10

b) Answer 02 questions out of 04 carrying 05 marks each  =2x05 = 10

c) Answer 02 questions out of 04 carrying 10 marks each  =2x10 = 20

However, questions, carrying 5 or 10 marks, need not necessarily to be a single question.

For each SEC paper, distribution of 50 marks be as follows:

i) Internal Assessment : 20% of 50 marks = 10 marks be reserved for class test/ assignment/ seminar.

ii) 40 marks be allotted for Semester-end-Theoretical Examination of each paper (Duration of Exam : 2 hours), distribution of which may be as under:

a) Answer 05 questions out of 08 carrying 02 marks each  = 5x2 = 10

b) Answer 02 questions out of 04 carrying 05 marks each  = 2x5 = 10

c) Answer 02 questions out of 04 carrying 10 marks each  = 2x10 = 20

However, questions, carrying 5 or 10 marks, need not necessarily to be a single question.

Mode of Practical Examination

Centre: Decided by the UGBS

Convener: The convener for each practical paper is to be nominated by the UGBS.

Examiners: One internal examiner of the concerned college and one external examiner are to be nominated by the UGBS. However, if any nominated external examiner does not accept the offer due to unavoidable circumstances to be substantiated by the document through proper channel, the Chairman of the UGBS can nominate the external examiner with the consultation of the convener.
Semester I
CORE COURSE (HONOURS IN ELECTRONIC SCIENCE)

CC-1: Theory: Basic Circuit Theory and Network Analysis (Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory
Lectures 60

Unit- 1


Unit- 2


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:

CC-1: Practical:
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 Kirchhoff’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.
CC 2: Mathematics Foundation for Electronics (Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory Lectures 60

Unit-1


Unit-2


Unit-3


Unit-4


Suggested Books
1. E. Kreyszig, advanced engineering mathematics, Wiley India (2008)

CC-2: Practical

Mathematics Foundation for Electronics Lab (Using C language/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.
SEMESTER-II
CC-3: Semiconductor Devices (Credits: Theory-04, Practicals-02)
F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)
Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory Lectures 60

Unit 1


Unit 2


Unit 3


Unit 4

Suggested Books:
2) S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley.

CC-3: Practical
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.
CC-4: Applied Physics (Credits: Theory-04, Practicals-02)
F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory Lectures 60

Unit-I


Unit-II


Unit-III


Unit-IV


Suggested Books:
CC-4: Practical
Applied Physics Lab
60 Lectures

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.
8. Determination of melting point of a solid using a thermocouple
9. To determine Young’s modulus of a bar by the method of flecture
10. Determination of effect of temperature on a semiconductor using (a) thermistor method (b) four probe method.
SEMESTER-III
CC-5: Electronics Circuits (Credits: Theory-04, Practicals-02)
F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)
Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory Lectures 60

Unit- 1 (14 Lectures)

Unit- 2 (15 Lectures)
Bipolar Junction Transistor: Review of CE, CB Characteristics and regions of operation. Hybridparameters. 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)
MOSFET Circuits: Review of Depletion and Enhancement MOSFET, Biasing of MOSFETs, Small Signal Parameters, Common Source amplifier circuit analysis, CMOS circuits.
Single tuned amplifiers: Circuit diagram, Working and Frequency Response for each, Limitations of single tuned amplifier, Applications of tuned amplifiers in communication circuits.

Suggested Books:
3. Electronic devices, David A Bell, Reston Publishing Company
9. Allen Mottershed, Electronic Devices and Circuits, Goodyear Publishing Corporation

CC-5: Practical
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
CC-6: Digital Electronics and Verilog/VHDL
(Credits: Theory-04, Practicals-02)
F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory Lectures 60

Unit-1
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
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
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
Introduction to Verilog: A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and Verilog, Introduction to Simulation and Synthesis Tools, Test Benches. Verilog 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, Integers, reals and strings. Logic Values, Data Types-net types, undeclared nets, scalars and vector nets, Register type, Parameters. Expressions, Operands, Operators, types of Expressions

Data flow Modeling and Behavioral Modeling: Data flow Modeling: Continuous assignment, net declaration assignments, delays, net delays.
Behavioral Modeling: Procedural constructs, timing controls, block statement, procedural assignments, conditional statement, loop statement, procedural continuous assignment.

Gate level modeling: Introduction, 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).

OR

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
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:

CC-6: Practical

Digital Electronics and Verilog/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 Verilog/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.
CC-7: C Programming and Data Structures  
(Credits: Theory-04, Practicals-02) 

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15) 

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, 
Practical (Sessional Viva-voce) - 05] 

Theory Lectures 60

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, post order and in 
order traversal (recursive)
Suggested Books:
1. YashavantKanetkar, Let Us C , BPB Publications
3. Byron S Gottfried, Programming with C , Schaum Series
CC-7: Practical
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.
Skill Enhancement Course
SEC-1: Design and Fabrication of Printed Circuit Boards (Credits: 02)
F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05]
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:

SEMMESTER-IV

CC-8: Operational Amplifiers and Application (Credits: Theory-04, Practicals-02)
F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory Lectures 60

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 butter worth filter, Second order filters, Band pass filter, Band reject filter, All pass filter, Log and antilog amplifiers.

Suggested Books:
CC-8: Practical
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 mono stable multivibrator.
11. Designing of Fixed voltage power supply using IC regulators using 78 series and 79 series
CC-9: Signals & Systems  
(Credits: Theory-04, Practicals-02)  
F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)  

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]  

Theory Lectures 60

Unit-1

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

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


Unit-4


Suggested Books:


CC-9: Practical  
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
CC-10: Electronic Instrumentation  
(Credits: Theory-04, Practicals-02)  
F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)  

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]  

Theory Lectures 60  

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 multi meters, 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)  

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 Power scope: 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 (photo resistors, photovoltaic cells, photodiodes).

**Suggested Books:**
1. H. S. Kalsi, Electronic Instrumentaion, TMH(2006)
4. Instrumentation Measurement and analysis: Nakra B C, Chaudry K, TMH

**CC-10: Practical**
**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
Skill Enhancement Course  
SEC-2: Robotics (Credits: 02) 
F.M. = 50 (Theory - 40, Internal Assessment – 10)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05]

Total Lectures 60

**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 programs 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 color 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

**Communication:** Wired RS232 (serial) Communication, Wireless Zig Bee Communication, USB Communication, Simplex infrared Communication (IR remote to robot)

**Suggested Books:**
SEMESTER-V

CC-11: Microprocessor and Microcontrollers
(Credits: Theory-04, Practicals-02)
F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory Lectures 60

Unit-1
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
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

Unit-3
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
Interfacing to PIC16F887: LED, Switches, Solid State Relay, Seven Segment Display, 16x2 LCD display, 4x4Matrix Keyboard, Digital to Analog Converter, Stepper Motor and DC Motor. Interfacing program examples using C language.

Suggested Books:
Core Course-XI: Practical
Microprocessor and Microcontrollers
Lab 60 Lectures
8085 Assembly language programs:
1. Program to transfer a block of data.
2. Program for multi byte addition
3. Program for multi byte 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. Generate sine, square, saw tooth, triangular and staircase waveform using DAC interface.
6. Display of 4- digit decimal number using the multiplexed 7-segment display interface.
7. Analog to digital conversion using internal ADC and display the result on LCD.
8. Implementation of DC-Volt meter (0-5V) using internal ADC and 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.
Unit-1 (16 Lectures)
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 (14 Lectures)
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 (13 Lectures)

Unit-4 (17 Lectures)


Suggested Books:

CC-12: Practical
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

DISCIPLINE SPECIFIC ELECTIVE COURSES (Credit 06 for each course)
DSE-1: Basic VLSI Design
(Credits: Theory-04, Practicals-02)
Unit- 1
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
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
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

Suggested Books:
4. Basic VLSI design: Douglas A Pucknell, Kamran Eshraghian, PHI, 5rd edition
OR DSE-1: Transmission Lines, Antenna and Wave Propagation

(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

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, Beam width, 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

DSE-2: Control Systems (Credits: Theory-04, Practicals-02)
F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)
Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory Lectures 60

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.
SEMESTER-VI
CC-13: Communication Electronics
(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/ Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory Lectures 60

Unit-1(10 Lectures)
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(20 Lectures)

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(14 Lectures)
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(16 Lectures)
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
5. Advanced electronic communications systems – Tomasi, 6th edition, PHI.

CC-13: Practical
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
CC-14: Photonics (Credits: Theory-04, Practicals-02)
F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory Lectures 60

Unit-1

Interference: Superposition of waves of same frequency, Concept of coherence, Interference by division of wave front, 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. Fraunhoffer Diffraction by a single slit, rectangular aperture, double slit, Resolving power of microscopes and telescopes; Diffraction grating: Resolving power and Dispersive power

Unit-2

Unit-3
Light Emitting Diodes: Construction, materials and operation.
Photo detectors: 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
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:

CC-14: Practical 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.

DISCIPLINE SPECIFIC ELECTIVE COURSES (Credit 06 for each course)
DSE-3: Modern Communication Systems
(Credits: Theory-04, Practicals-02)
F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory Lectures 60

Unit-1
(16 Lectures)
Advanced Digital Modulation Technique: DPCM, DM, ADM. Binary Line Coding Technique, Multi level coding, QAM (Modulation and Demodulation)

Unit-2
(10 Lectures)
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
(17 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.

Unit-4
(17 Lectures)
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:
Englewood Cliffs, 3rd Edition


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

OR DSE-3: Numerical Analysis
(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment |Class Attendance (Theory) – 05, Theory (Class Test/
Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

Theory Lectures 60

Unit-1
Solution of Transcendental and Polynomial Equations f(x)=0: Bisection method, Secant and RegulaFalsi 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
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
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
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 RegulaFalsi 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-4: Digital Signal Processing**
(Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]
Theory Lectures 60

Unit- 1
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
Z-Transform: Definition and properties, Inverse Z Transform and stability. Parsevals Theorem and applications.

Unit- 3
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

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.
OR DSE-4: DISSERTATION

Guidelines:

Selection Criteria: Only 10% (of total appeared students of Semester-V) students in a given college to be chosen on the basis of total Credit earned in the last ‘available’ results of different completed semesters.

Topic: Any advance topic in the domain of ‘recent advances of Electronics

- Students can consult the information available in the internet, but under any circumstance the candidates will not use the ‘Copy and Paste’ of the said information. If it is found the candidate will be disqualified for this paper.
- Allotment of the supervisor will be made through the approval of the department duly endorsed by the Principal. Maximum two supervisors can be allotted for each candidate.
- One supervisor can guide only one student in a given semester.

Evaluation procedure: Total marks = 75 (Credit = 6)

Internal Assessment = 35

Internal Assessment will be done by all the teachers in the department. For this evaluation marks will be distributed as follows:

Preparation of the dissertation : 15
Presentation of the dissertation : 10
Merit of the dissertation and Viva-voce : 10

End Semester Evaluation: 40 Marks

The department of Physics, The University of Burdwan, will arrange for the assessment of the dissertation using the following method:

1) A board consisting of 5 teachers of the department will be formed after getting approval of the departmental committee meeting.

2) Marks distribution:

   Preparation of the dissertation : 15
   Presentation of the dissertation : 15
   Merit of the dissertation and Viva-voce : 10
Generic Elective Papers (GE) (Minor-Electronic Science) (any four) for other Departments/Disciplines: (Credit: 06 each)

Semester-I

GE-1: Electronic Circuits and PCB Designing (Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

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 inter conversion, superposition theorem, maximum power transfer theorem.

Unit 2


Zener diode regulator: circuit diagram and explanation for load and line regulation, disadvantages of Zener diode regulator.

Unit-3


Transistor biasing: need for biasing, DC load line, operating point, thermal runaway, stability and stability factor.

Voltage divider bias: circuit diagrams and their working, Q point expressions for voltage divider biasing.

Small signal CE amplifier: circuit, working, frequency response, re model for CE configuration, derivation for Av, Zin and Zout.

Unit-4

Types of PCB: Single sided board, double sided, Multilayer boards, Plated through holes technology, Benefits of Surface Mount Technology (SMT), Limitation of SMT, Surface mount components: Resistors, Capacitor, Inductor, Diode and IC’s.


Basic artwork approaches, Artwork taping guidelines, General artwork rules: Artwork check and Inspection.
Laminates and Photo printing: Properties of laminates, Types of Laminates, Manual cleaning process, Basic printing process for double sided PCB’s, Photo resists, wet film resists, Coating process for wet film resists, Exposure and further process for wet film resists, Dry film resists


Suggested Books:
5. Basic Electronics and Linear circuits, N.N. Bhargava, D.C. Kulshresta and D.C Gupta -TMH.
9.

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
Semester-II

GE-2: Practical Electronics (Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

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 and 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:
3. Electrical Measurements & Electronic Measurements by A.K. Sawhney
5. Instrumentation- Devices and Systems By Rangan, Sarma, and Mani, Tata-McGraw
Hill
7. Instrumentation measurements and analysis by Nakra&Choudhary
6. Measurement & Instrumentation- DVS Murthy
10. Exploring Arduino, Jeremy Blum, Wiley
11. Beginning Arduino, Michael McRobetrs, Technology in Action
12. Beginning Arduino Programming, Brian Evans ,Technology in Action
13. Practical Arduino Engineering, Harold Timmis, Technology in Action
14. Practical Arduino : Cool Projects for open source hardware, Jonathan Oxer, Hugh Blemings, Technology in Action
15.
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 light wave 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 1second.
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
Semester-III

GE-3: Digital System Design (Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

<table>
<thead>
<tr>
<th>Unit</th>
<th>Lectures</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>(11 lectures)</td>
<td>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).</td>
</tr>
<tr>
<td>3</td>
<td>(16 lectures)</td>
<td>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).</td>
</tr>
<tr>
<td>4</td>
<td>(18 Lectures)</td>
<td>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).</td>
</tr>
</tbody>
</table>

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.
Semester-IV
GE-4: Communication Systems (Credits: Theory-04, Practicals-02)

F.M. = 75 (Theory - 40, Practical – 20, Internal Assessment – 15)

Internal Assessment [Class Attendance (Theory) – 05, Theory (Class Test/Assignment/ Tutorial) – 05, Practical (Sessional Viva-voce) - 05]

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)

Unit-3 (16 Lectures)

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