CHOICE BASED CREDIT SYSTEM

B. Sc. Program with Electronics

Department of Electronic Science
University of Delhi South Campus
New Delhi 110021

JUNE 2015
Syllabus and Scheme of Examination

for

B.Sc. Program with Electronics

under

Choice Based Credit System

June 2015
## Details of Courses Under Undergraduate Programme (B.Sc.)

<table>
<thead>
<tr>
<th>Course</th>
<th>Theory+ Practical</th>
<th>Theory+Tutorials</th>
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</thead>
<tbody>
<tr>
<td>I. Core Course (12 Papers)</td>
<td>12X4= 48</td>
<td>12X5=60</td>
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<tr>
<td>(12 Papers)</td>
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<tr>
<td>04 Courses from each of the 03 disciplines of choice</td>
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<tr>
<td>Core Course Practical / Tutorial* (12 Practical/ Tutorials*)</td>
<td>12X2=24</td>
<td>12X1=12</td>
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<tr>
<td>(12 Practical/ Tutorials*)</td>
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<tr>
<td>04 Courses from each of the 03 Disciplines of choice</td>
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<tr>
<td>II. Elective Course (6 Papers)</td>
<td>6x4=24</td>
<td>6X5=30</td>
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<tr>
<td>Two papers from each discipline of choice including paper of interdisciplinary nature.</td>
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<tr>
<td>Elective Course Practical / Tutorials* (6 Practical / Tutorials*)</td>
<td>6 X 2=12</td>
<td>6X1=6</td>
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<tr>
<td>(6 Practical / Tutorials*)</td>
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<tr>
<td>Two Papers from each discipline of choice including paper of interdisciplinary nature</td>
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<tr>
<td>• Optional Dissertation or project work in place of one Discipline elective paper (6 credits) in 6th Semester</td>
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<tr>
<td>III. Ability Enhancement Courses</td>
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<tr>
<td>1. Ability Enhancement Compulsory Courses (AECC) (2 Papers of 2 credits each)</td>
<td>2 X 2=4</td>
<td>2X2=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. Skill Enhancement Courses (SEC)</td>
<td>4 X 2=8</td>
<td>4 X 2=8</td>
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<tr>
<td>(4 Papers of 2 credits each)</td>
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<tr>
<td>Total credit= 120</td>
<td>Total credit= 120</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 practical there will be no tutorials and vice-versa
# Proposed Scheme for Choice Based Credit System in B.Sc. Program with Electronics

<table>
<thead>
<tr>
<th>CORE COURSE (12)</th>
<th>Ability Enhancement Compulsory Course (AECC) (2)</th>
<th>Skill Enhancement Course (SEC) (2)</th>
<th>Discipline Specific Elective DSE (6)</th>
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<tbody>
<tr>
<td>I</td>
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<tr>
<td>DSC- 1 A</td>
<td>(English/MIL Communication)/Environmental Science</td>
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<tr>
<td>DSC- 2 A</td>
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<tr>
<td>Basic Circuits and Devices</td>
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<tr>
<td>II</td>
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<tr>
<td>DSC- 1 B</td>
<td>Environmental Science / (English/MIL Communication)</td>
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<tr>
<td>DSC- 2 B</td>
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<tr>
<td>Analog Circuits</td>
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<td>III</td>
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<td>DSC- 1 C</td>
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<td>SEC-1</td>
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<tr>
<td>DSC- 2 C</td>
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<tr>
<td>Digital Electronics and Microprocessor</td>
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<td>IV</td>
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<tr>
<td>DSC- 1 D</td>
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<td>SEC-2</td>
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<tr>
<td>DSC- 2 D</td>
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<tr>
<td>Communication Electronics</td>
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<tr>
<td>V</td>
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<td>SEC -3</td>
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<td>DSE-1 A</td>
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<td>DSE-2 A</td>
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<tr>
<td></td>
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<td>DSE-3 A</td>
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### Semester-Wise Schedule for B.Sc. Program with Electronics

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Opted</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>I</td>
<td>Ability Enhancement Compulsory</td>
<td>English/MIL communications/ Environmental Science</td>
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<td>Course-I</td>
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<td>Core course-I</td>
<td>DSC-1A</td>
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<tr>
<td></td>
<td>Core course-II</td>
<td>DSC-2A</td>
<td>6</td>
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<tr>
<td></td>
<td>Core course-III</td>
<td>Basic Circuits and Devices</td>
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<td></td>
<td>Core Course-III Practical/Tutorial</td>
<td>Basic Circuits and Devices Lab</td>
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<tr>
<td>II</td>
<td>Ability Enhancement Compulsory</td>
<td>English/MIL communications/ Environmental Science</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Course-II</td>
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<tr>
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<td>Core course-IV</td>
<td>DSC-1B</td>
<td>6</td>
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<tr>
<td></td>
<td>Core course-V</td>
<td>DSC-2B</td>
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<tr>
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<td>Core course-VI</td>
<td>Analog Circuits</td>
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<tr>
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<td>Core Course-VI Practical/Tutorial</td>
<td>Analog Circuits Lab</td>
<td>2</td>
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<tr>
<td>III</td>
<td>Core course-VII</td>
<td>DSC-1C</td>
<td>6</td>
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<tr>
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<td>Core course-VIII</td>
<td>DSC-2C</td>
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<tr>
<td></td>
<td>Core course-IX</td>
<td>Digital Electronics and Microprocessor</td>
<td>4</td>
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<tr>
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<td>Core Course-IX Practical/Tutorial</td>
<td>Digital Electronics and Microprocessor Lab</td>
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<tr>
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<td>Skill Enhancement Course-1</td>
<td>SEC-1</td>
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<tr>
<td>IV</td>
<td>Core course-X</td>
<td>DSC-1D</td>
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<tr>
<td></td>
<td>Core course-XI</td>
<td>DSC-2D</td>
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<tr>
<td></td>
<td>Core course-XII</td>
<td>Communication Electronics</td>
<td>4</td>
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<tr>
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<td>Core Course-XII Practical/Tutorial</td>
<td>Communication Electronics Lab</td>
<td>2</td>
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<tr>
<td></td>
<td>Skill Enhancement Course-2</td>
<td>SEC-2</td>
<td>2</td>
</tr>
</tbody>
</table>
### Skill Enhancement Course (SEC)

- SEC-3: 2

### Discipline Specific Elective (DSE)

- DSE-1A: 6
- DSE-2A: 6
- DSE-3A: 6

### Discipline Specific Elective (DSE)

- DSE-1B: 6
- DSE-2B: 6
- DSE-3B: 6

### Total Credits: 120

**CORE COURSE (DSC 3A, 3B, 3C, 3D): (Credit: 06 each) (4 papers)**

(1 period/week for tutorials or 4 periods/week for practical)

1. Basic Circuits and Devices (4+4)
2. Analog Circuits (4+4)
3. Digital Electronics and Microprocessor (4+4)
4. Communication Electronics (4+4)

**Discipline Specific Electives (DSE): (Credit: 06 each) (2 papers to be selected):**

#### DSE-3A, DSE-3B

1. Industrial Electronics (4+4)
2. Semiconductor Fabrication and Characterization (4+4)
3. Electrical Machines (4+4)
4. Embedded Systems (4+4)
5. Biomedical Instrumentation (4+4)
6. Dissertation (4+4)

**Skill Enhancement Course (SEC) (Any 04 papers) (Credit: 02 each) – SEC1 to SEC4**

1. Programming with C (4)
2. Computer Hardware and Maintenance (4+4)
3. Digital System design using VHDL (4)
4. Design and Fabrication of Printed Circuit Boards (4)
5. Robotics (4)
6. Mobile Applications Development (4)
Important:

1. Each University/Institute should provide a brief write-up about each paper outlining the salient features, utility, learning objectives and prerequisites.
2. University/Institute can add/delete some experiments of similar nature in the Laboratory papers.
3. The size of the practical group for practical papers is recommended to be 12-15 students.
4. University/Institute can add to the list of reference books given at the end of each paper.
Basic Circuits and Devices

(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit- 1


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- 2

AC Circuit Analysis: Sinusoidal Voltage and Current, Definition of Instantaneous, Peak, Peak to Peak, Root Mean Square and Average Values. AC applied to Series RC and RL circuits: Impedance of series RC & RL circuits.

AC applied to Series and parallel RLC circuit, Series and Parallel Resonance, condition for Resonance, Resonant Frequency, Bandwidth, significance of Quality Factor (Q).


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.

Impedance (Z) Parameters, Admittance (Y) Parameters, Hybrid parameters

Unit-3

Diode Circuits: Ideal diode, pn diode and its characteristics., dc load line analysis, Quiescent (Q) point. Clipping and clamping circuits. Rectifiers, HWR, FWR (center tapped and bridge), Circuit diagrams, working and waveforms, ripple factor & efficiency, comparison. Filter types, circuit diagram and explanation of shunt capacitor filter with waveforms.

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

Unit-4

Bipolar Junction Transistor: CE, CB Characteristics and regions of operation, Transistor biasing, DC load line, operating point, thermal runaway, idea about stability and stability factor. Voltage divider bias, circuit diagrams and their working.


MOSFET, Construction, Working and Characteristics.

Suggested books:

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

Basic Circuits and Devices Lab (Hardware and Circuit Simulation Software)
60 Lectures

1. Verification of Kirchoff’s Law.
2. Verification of Norton’s Theorem.
3. Verification of Thevenin’s Theorem.
4. Verification of Superposition Theorem.
5. Verification of the Maximum Power Transfer Theorem.
6. RC Circuits: Time Constant, Differentiator, Integrator.
9. Study of the half wave rectifier and Full wave rectifier.
10. Study of power supply using C filter and Zener diode.
11. Study of clipping circuits
12. To study clamping circuits
13. Study of Voltage divider bias Feedback configuration for transistors.
15. 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.
Analog Circuits  
(Credits: Theory-04, Practicals-02)  

Unit- 1  

(16 Lectures)

**BJT CE Amplifier:** dc and ac load line analysis, hybrid model, Quantitative study of the frequency response, Effect on gain and bandwidth for Cascaded amplifiers (RC coupled).

**Power Amplifiers:** Difference between voltage and power amplifier, classification of power amplifiers, Class A, Class B, Class C and their comparisons. Operation of a Class A single ended power amplifier. Operation of Transformer coupled Class A power amplifier, overall efficiency. Circuit operation of complementary symmetry Class B push pull power amplifier, crossover distortion, heat sinks.

**Single tuned amplifiers:** Circuit diagram, Working and Frequency Response for each, Limitations of single tuned amplifier, Applications of tuned amplifiers in communication circuits.

Unit- 2  

(16 Lectures)

**MOSFET Circuits:** Review of Depletion and Enhancement MOSFET, Biasing of MOSFETs, Small Signal Parameters, Common Source amplifier circuit analysis, CMOS circuits.

**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, Colpitt’s oscillator.

Unit- 3  

(16 Lectures)

**Operational Amplifiers:** Block diagram, equivalent circuit, Open and closed loop configuration, Frequency response of an op-amp in open loop and closed loop configurations, definition of various op-amp parameters: input bias current, input offset voltage, output offset voltage, CMRR, slew rate, SVRR, Characteristics of ideal and practical op-amps. Limitations of op-amp in open loop mode.

**Op-Amp Circuits:** Inverting and non-inverting amplifier, Summing Amplifier, Difference Amplifier, Integrator, Differentiator, Instrumentation Amplifier, Voltage to current converter, Current to Voltage converter, Sample and Hold circuits.

Unit- 4  

(12 Lectures)

**First order active filters:** low pass, high pass, band pass, band reject and all pass filters.

**Comparators:** Basic comparator, Level detector, Voltage limiters, Schmitt Trigger.

**Multivibrators (IC 555):** Functional block diagram of 555 timer, Monostable and Astable operation.
Suggested Books:

2. Electronic devices, David A Bell, Reston Publishing Company
7. H. S. Kalsi, Electronic Instrumentation, TMH(2006)
9. Instrumentation Measurement and analysis: Nakra B C, Chaudhry K, TMH

Analog Circuits Lab (Hardware and Circuit Simulation Software)

60 Lectures

1. Study of the Colpitt’s Oscillator.
2. Study of the Phase Shift Oscillator
4. Designing of an amplifier of given gain for an inverting and non-inverting configuration using an op-amp.
5. Designing of an integrator using op-amp.
7. Designing of a First Order Low-pass filter using op-amp.
8. 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. Design of multi range ammeter and voltmeter using galvanometer.
Digital Electronics and Microprocessors  
(Credits: Theory-04, Practicals-02)

**Theory Lectures 60**

**Unit-1**  
(10 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, Gray and ASCII Codes.

**Logic Gates and Boolean algebra:** Truth Tables of OR, AND, NOT, XOR, XNOR, Universal (NOR and NAND) Gates, Basic postulates and fundamental theorems of Boolean algebra.

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

**Unit-2**  
(22 Lectures)

**Combinational logic analysis and design:** Standard representation of logic functions (SOP and POS), Minimization Techniques (k Map technique) up to 4 variable

Multiplexers and Demultiplexers, Adder and Subtractor (half and full) and their use as subtractor, Encoder and Decoder, Code Converter (Binary to BCD and vice versa)

**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-3**  
(14 Lectures)

**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.

**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.

**Unit-4**  
(14 Lectures)

Stack operations, subroutine calls and return operations. Delay loops, use of counters

Interrupts: Hardware and software interrupts, Interrupt priorities, SIM and RIM instructions

Interfacing of memory chips, address allocation technique and decoding; Interfacing of I/O devices, LEDs and toggle-switches, memory mapped and isolated I/O structure; IN and OUT instruction.

**Suggested Books:**

Digital Electronics and Microprocessors 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 4 X 1 Multiplexer using gates.
6. To build a Flip- Flop Circuits using elementary gates. (RS, Clocked RS, D-type).
8. Design a shift register and study Serial and parallel shifting of data.
9. Program to transfer a block of data.
10. Program for multibyte addition
11. Program for multibyte subtraction
12. Program to multiply two 8-bit numbers.
13. Program to divide a 16 bit number by 8 bit number.
14. Program to search a given number in a given list.
15. Program to generate terms of Fibonacci series.
16. Program to sort numbers in ascending/descending order.
17. Program to find the square root of an integer.
Communication Electronics
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1  

Introduction: Block diagram of an electronic communication system, modulation and demodulation, electromagnetic spectrum band designations and applications. Waveform spectra and effect of filtering on complex signals.

Analog Modulation: Amplitude Modulation: Frequency spectrum of AM waves, average power, average voltage, modulation index, AM-modulator circuits (collector modulation), AM-demodulator (diode detector), single side band generation and detection.

Angle Modulation: Frequency and phase modulation, frequency spectrum of FM waves, intersystem comparisons (FM and AM), FM generation and detection

Frequency division multiplexing (FDM).

Unit-2  

Transmitters and Receivers: Communication channels for AM and FM broadcast, AM and FM transmitter, tuned RF receiver, Superheterodyne receiver (AM and FM).

Pulse Analog Modulation: Sampling Theorem and Nyquist Criterion. Pulse Modulation: pulse amplitude modulation (PAM), pulse width modulation (PWM) and pulse position modulation (PPM). Time division multiplexing (TDM).

Pulse Code Modulation: Need for digital transmission, Block Diagram of a PCM system.

Unit-3  


Optical Communication: Introduction of Optical Fiber, Block Diagram of optical communication system.

Unit-4  

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, Comparative study of GSM and CDMA, 2G, 3G and 4G concepts.

Satellite communication: Introduction, 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)
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,
Industrial Electronics
(Credits: Theory-04, Practicals-02)  
Theory Lectures 60

Unit-1  
(15 Lectures)

**Thyristors:** Principles and operations of SCR, Voltage amplifier gate characteristics of SCR, Characteristics of two transistor models, Thyristor construction, Rectifier circuit using SCR, GTO, Operation and characteristics of DIAC, TRIAC, Silicon Controlled Switch, Silicon Unilateral Switch, Silicon Bilateral Switch, and Light activated SCR.

Unit-2  
(13 Lectures)

**Turn ON/OFF Mechanism:** Types of turn on methods: AC gate triggering, R triggering, RC triggering, DC gate triggering, Pulse triggering, Types of turn off methods: Natural commutation, Forced Commutation, Self Commutation, Complimentary commutation, Auxiliary commutation, External pulse commutation, Line commutation, Thyristor rating.

Unit-3  
(15 Lectures)

**Applications of SCR:** Multiple connections of SCR, Series operation, Triggering of series connected SCR, Parallel operation, Triggering of parallel connected SCR, SCR di/dt calculation, Snubber circuit, dv/dt calculation across SCR, Types of converters, Half wave rectifiers with resistive load, HWCR with inductive load, HWCR with free wheeling diode, Full wave controlled rectifier with resistive load, FWCR with inductive load, FWCR with free wheeling diode.

Unit-4  
(17 Lectures)

**Inverters:** Types of inverters, Single phase bridge inverter, Mc Murray impulse communication inverter, Single phase half bridge voltage source inverter, Single phase full bridge voltage inverter, Step down choppers, Step up choppers, Chopper classification.

**Other Applications:** Induction heating, Resistance welding, Over voltage protection, Zero voltage switch, SMPS,UPS, DC circuit breaker, Battery charger, AC static switch, DC static switch, Time delay, Fan regulator using TRIAC.

**Suggested Books:**
Industrial 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. Study of chopper circuits
Semiconductor Fabrication and Characterization  
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit- 1  
(19 Lectures)

**Introduction of Semiconductor Process 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).  
**Characterization:** Various characterization methods for structural, electrical and optical properties. Basic idea of X-ray diffractometer, Scanning electron microscope, Transmission electron microscope and UV-VIS-NIR spectrophotometer.

Unit-2  
(15 Lectures)

**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  
(15 Lectures)

**Lithographic Processes:** Clean room, Optical lithography, exposure tools, masks, Photoresist, Pattern Transfer, Resolution Enhancement Technique. Electron Beam Lithography, X-ray Lithography and Ion Beam Lithography. Comparison between various lithographic techniques.  
**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  
(11 Lectures)


**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.
Electrical Machines
(Credits: Theory-04, Practicals-02)

Unit- 1
(20 Lectures)

Electromechanical Machines: DC Machines Basics: 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.
Embedded Systems
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit – 1


Unit – 2

AVR RISC Microcontrollers: Introduction, 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

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

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, SarmadNaimi, SepehrNaimi, PHI
2. Embedded system Design - Frank Vahid and Tony Givargis, John Wiley, 2002
3. Programming and Customizing the AVR Microcontroller by D V Gadi, 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.
Biomedical Instrumentation
(Credits: Theory-04, Practicals-02)

Total Lectures 60

Unit-1 (13 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-2 (15 Lectures)

Bio-medical instrumentation:

Unit -3 (16 Lectures)


Unit-4 (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.

Suggested Books:
1. Handbook of biomedical instrumentation: Khandpur R S, TMH
11. 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. Measurement of respiration rate using thermister /other electrodes.
6. Determination pulmonary function using spirometer (using mechanical system).
7. Measurement of respiration rate using thermister /other electrodes.
8. Study of Respiration Rate monitor/ apnea monitor
9. Study on ultrasound transducers based on medical system
10. Study of a Pacemaker.
11. Measurement of pulse rate using photoelectric transducer & pulse counting for known period.
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).

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: concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointers to pointers, pointers and multidimensional arrays
Introduction to C++: Object oriented programming, characteristics of an object-oriented language.

Suggested Books:

1. Yashavant Kanetkar, Let Us C, BPB Publications
3. Byron S Gottfried, Programming with C, Schaum Series
### Introduction to PC Architecture

### Internal Components
IDE and SATA Devices: Hard Disk Drive and CD/DVDs Drives, SCSI Devices, Floppy Disk, Zip Drive, Backup Drive, Expansion Cards- LAN Card, IDE Card, VGA and SVGA Cards, Sound Card, Interface Cards, I/O cards, Video Cards, USB Card, Fire-Wire Cards, Internal Ports, Cables and Connector Types.

### External Components

### CPU Cabinet
Power supply, SMPS, Motherboard, CPU, Cables and connectors, Main and auxiliary memory, Front and rear panel study.

### Network Components
Introduction of Network Cable like UTP, STP, Fiber Optics, Hub, Unmanageable Switch, Manageable Switch, Router, Modem, Wi-Fi, Access Point, PCI Wireless Card, USB Wireless Device, Print Server, USB Network Sharer, Backup Device, Server Hardware etc.

### Operating System Basics & Installation
Introduction to OS, Types of Operating systems, System files FAT and NTFS, Dos 6.22, Windows XP, Windows Vista, Windows 7 and Windows 8, RedHat Linux, Ubuntu, application software installation

### Device Installation

### Diagnostic Tools & PC Maintenance

### Basic Network Introduction & Installation

### Suggested Books:
1. PC Troubleshooting and Repair Stephen J. Bigelow Dream tech Press, New Delhi
2. PC and Clones Hardware, Troubleshooting and Maintenance B. Govinda Rajalu, Tata McGraw Hill Publication
Digital System Design using VHDL
(Credits: 02)

Total Lectures 60

**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:**

**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:**


Robotic 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 operating system, Comparison of Android, iOS and Windows phone


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: What is an Intent, Implicit Intents and Explicit Intents, Intents with Activities, Intents with Broadcast Receivers

Advanced Android, New Features in Android 4.4,
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, WroxPublication