Choice Based Credit System (CBCS)

UNIVERSITY OF DELHI

FACULTY OF INTER-DISCIPLINARY & APPLIED SCIENCES

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

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

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

Undergraduate Programme Secretariat

Preamble

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

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

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

CHOICE BASED CREDIT SYSTEM (CBCS):

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

Outline of Choice Based Credit System:

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

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Details of Courses Under Undergraduate Programme (B.Sc.)

Course	***Credits**	
	Theory+ Practical	Theory+Tutorials
I. Core Course	12X4= 48	12X5=60
(12 Papers)		
04 Courses from each of the		
03 disciplines of choice		
Core Course Practical / Tutorial*	12X2=24	12X1=12
(12 Practical/ Tutorials*)		
04 Courses from each of the		
03 Disciplines of choice		
II. Elective Course	6x4=24	6X5=30
(6 Papers)		
Two papers from each discipline of choice		
including paper of interdisciplinary nature.		
Elective Course Practical / Tutorials*	6 X 2=12	6X1=6
(6 Practical / Tutorials*)		
Two Papers from each discipline of choice		
including paper of interdisciplinary nature		
III. Ability Enhancement Courses		
1**. Ability Enhancement Compulsory**	2 X 2=4	2X2=4
(2 Papers of 2 credits each)		
Environmental Science		
English/MIL Communication		
2**. Ability Enhancement Elective**	4 X 2=8	4 X 2=8
(Skill Based)		
(4 Papers of 2 credits each)		
	Total credit= 120	**Total credit= 120**

- **Optional Dissertation or project work in place of one Discipline elective paper (6 credits) in 6th Semester**

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**

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 (15 Lectures)

Basic Circuit Concepts: Voltage and Current Sources, Review of Resistors, Inductors, Capacitors. Circuit Analysis: Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Node Analysis, Mesh Analysis.

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 (19 Lectures)

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).
Passive Filters: Low Pass, High Pass.

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 (14 Lectures)

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 (12 Lectures)

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.

Field Effect Transistors: JFET, Construction, Working and Characteristics.

MOSFET, Construction, Working and Characteristics.

Power Devices: UJT, Construction, Working and Characteristics. SCR, Diac, Triac, Construction, Working and Characteristics and Applications.

Suggested books:

1. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill (2004)
2. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill.(2005)
3. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill(2005)
4. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)
5. Electronic Devices and circuit theory, Robert Boylstead and Louis Nashelsky, 9th Edition, 2013, PHI
6. Electronic devices, David A Bell, Reston Publishing Company
7. D. L. Schilling and C. Belove, Electronic Circuits: Discrete and Integrated, Tata McGraw Hill (2002)
8. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw Hill (2002)
9. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
10. J. R. C. Jaegar and T. N. Blalock, Microelectronic Circuit Design, Tata McGraw Hill (2010)
11. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)
12. Allen Mottershed, Electronic Devices and Circuits, Goodyear Publishing Corporation

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

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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.
7. Designing of a Low Pass RC Filter and study of its Frequency Response.
8. Designing of a High Pass RC Filter and study of its Frequency Response.
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.
14. Designing of a Single Stage CE amplifier.
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)

Theory Lectures 60

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:

1. Electronic Devices and circuit theory, Robert Boylstead and Louis Nashelsky, 9th Edition, 2013, PHI
2. Electronic devices, David A Bell, Reston Publishing Company
3. D. L. Schilling and C. Belove, Electronic Circuits: Discrete and Integrated, Tata McGraw Hill (2002)
4. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw Hill (2002)
5. R. A. Gayakwad, Op-Amps and Linear IC's, Pearson Education (2003)
6. R. F. Coughlin and F. F. Driscoll, Operational amplifiers and Linear Integrated circuits, Pearson Education (2001)
7. H. S. Kalsi, Electronic Instrumentation, TMH(2006)
8. W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice-Hall (2005).
9. Instrumentation Measurement and analysis: Nakra B C, Chaudhry K, TMH
10. David A. Bell, Electronic Instrumentation and Measurements, Prentice Hall (2013).
11. A. K Sawhney, Electrical and Electronics Measurements and Instrumentation, DhanpatRai and Sons (2007).

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

1. Study of the Colpitt's Oscillator.
2. Study of the Phase Shift Oscillator
3. Study of op-amp characteristics: CMRR and Slew rate.
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.
6. Designing of a differentiator 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:

1. M. Morris Mano Digital System Design, Pearson Education Asia,(Fourth Edition)

2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
3. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India(2000)
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
5. Microprocessor Architecture, Programming and Applications with 8085, Ramesh S.Gaonkar - Wiley Eastern Limited- IV Edition.

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).
7. Design a counter using D/T/JK Flip-Flop.
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 (15 Lectures)

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 (15 Lectures)

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 (15 Lectures)

Digital Carrier Modulation Techniques: Block diagram of digital transmission and reception. Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK)

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

Unit -4 (15 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, 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
2. Principles of Electronic communication systems – Frenzel, 3rd edition, McGraw Hill
3. Communication Systems, S. Haykin, Wiley India (2006)
4. Advanced electronic communications systems – Tomasi, 6th edition, PHI.
5. Communication Systems, S. Haykin, Wiley India (2006)

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,
14. Study of Frequency 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:

1. Harish C Rai, " Power Electronic Devices, Circuits, Systems and Applications", Gac Gotia Publication Pvt. Ltd., 1st Edition, 1998
2. Ramamourthy " Thyristor and their applications" East-West Publishers, 2nd Edition
3. Shamir K Datta " Power Electronics and Controllers" PHI, 3rd Edition

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 Brigdman 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.
Diffusion: Basic Diffusion Process: Diffusion Equation, Diffusion Profiles. Extrinsic Diffusion Concentration Dependent Diffusivity. Lateral Diffusion. Doping through Ion Implantation and its comparison with diffusion.

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)

Process Integration: Passive components- Integrated Circuit Resistor, Integrated Circuit Inductor, Integrated Circuit Capacitor. Bipolar Technology: Basic fabrication process, Isolation techniques. MOSFET Technology: Basic fabrication process of NMOS, PMOS and CMOS technology.

Suggested Books:

1. Gary S.May and S,M.Sze , Fundamentals of Semiconductor Fabrication, John Wiley& Sons(2004)
2. LudmilaEckertova, Physics of Thin films, 2nd Edition, Plenum Press (1986).

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)

Theory Lectures 60

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

Single Phase Motors: Single phase induction motors, Construction, principle of operation based on starting methods, Split phase motors, capacitor start motors, capacitor start & run motors, Reluctance Motor, Stepper Motor, Single phase a.c. series motors, Universal 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:

1. B.L. Thareja, A.K. Thareja, A Textbook of Electrical Technology-Vol-II, S.Chand
2. J.B. Gupta, Electrical Technology (Electrical Machines), Katsons
3. I. J. Nagrath and D. P. Kothari, Electrical Machines, Tata McGraw Hill
4. G. Mc. Pherson, An introduction to Electrical Machines & Transformers, John Wiley & Sons
5. H. Cotton, Advanced Electrical Technology, CBS Publishers and Distributors, New Delhi
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.
3. Study of characteristics of single phase induction motor.
4. Study of characteristics of three phase induction motor.
5. Study of control of DC motor using SCR.
6. Study of Open Circuit Test on single phase transformer.
7. Study of Short Circuit Test on single phase transformer.

Embedded Systems
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit – 1 (10 Lectures)

Embedded Systems: Introduction, Features, Requirements and Applications, Recent Trends in the Embedded System Design, Common architectures for the Embedded System Design, Embedded Software design issues. Introduction to microcontrollers, Overview of Harvard architecture and Von Neumann architecture, RISC and CISC microcontrollers

Unit –2 (17 Lectures)

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 (17 Lectures)

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

Unit – 4 (16 Lectures)

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

Suggested Books:

1. AVR Microcontroller and Embedded Systems: Using Assembly and C by Muhammad Ali Mazidi, 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 Gadre, McGraw-Hill
4. Atmel AVR Microcontroller Primer: Programming and Interfacing by Steven F. Barrett, Daniel J. Pack, Morgan & Claypool Publishers
5. An Embedded Software Primer by David E Simon, Addison Wesley
6. AVR Microcontroller Datasheet, Atmel Corporation, www.atmel.com

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:
Bio-Amplifiers: Bio potentials - Bio-electricity - Necessity for special types of amplifiers for biological signal amplifications - Different types of Bio-OP - Amps. Electrodes for ECG, EEG, and EMG, block diagram of ECG and EEG systems, brief analysis of graphs.

Unit - 3 (16 Lectures)
Patient Monitoring systems & Audiometers: Cardiac monitor, Bedside patient monitor, measurement of heart rate, blood pressure, temperature, respiration rate, Arrhythmia monitor, Methods of monitoring fatal heart rate, Monitoring labor activity. Audiometers: Audiometers, Blood cell counters, Oximeter, Blood flow meter, cardiac output measurement, Blood gas analyzers.

Unit - 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
2. Measurement systems applications and design: Doeblin E O, McGraw Hill, 1990.
3. Electron measurements and instrumentation techniques: Cooper W D and Helfric A D, PHI, 1989.
4. Biomedical instrumentation and measurements: Leslie-Cromwell, Fred J Weibell, Erich A Pfieffer, PHI, 1994.
5. Mechatronics – principles and applications, Godfrey C Onwubolu, Elsevier, 2006
6. Joseph J. Carr & John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson.

7. Shakti Chatterjee, “Textbook of Biomedical Instrumentation System”, Cengage Learning Khandpur R. S. - Handbook of Biomedical Instrumentation, TMH
8. Bertil Jacobson & John G. Webster - Medicine and Clinical Engineering, PHI
9. Prof. S.k.VenkataRam-Bio-Medical Electronics and Instrumentation, Galgotia Publications
10. John G.Webster- Medical Instrumentation-Application and Design Wiley Student Edition)
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.

Programming with C
(Credits: 02)

Theory Lectures 60

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
2. Programming in ANSI C, Balagurusamy, 2nd edition, TMH.
3. Byron S Gottfried, Programming with C , Schaum Series
4. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, Prentice Hall
5. Yashavant Kanetkar, Pointers in C, BPB Publications

Computer Hardware and Maintenance
(Credits: 02)

Total Lectures 60

Introduction to PC Architecture: Study of PC-AT/ATX System, Pentium, Core, Core 2 Cord, Core 2 Duo, I3, I5, I7 Processor Basics of Processor and CPU Block Diagram of Computer and Computer Generation Motherboards, Chipset and Controllers, BIOS and the Boot Process, Computer Memory.

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 : CRT, LCD and LED Displays, Dot-Matrix Printer, Inkjet Printer, Laser Printer, Photo Scanner, Documents Scanner, Bar Cord Scanner, Keyboards, Mouse, External Modem, Ports and Connectors, Batteries, Power supply, Pen Drives, SCSI interface devices, Laptop Computers, Digital Advance storage technology.

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: Graphics Card, Sound Card, LAN Card, Wireless LAN Card, SCSI Card, External Drive, Flash Cards, Web Camera, CCTV Camera, Mobile Devices, Pen Drive, Firewire Cards, Modem, Plotter, Wireless LAN, Access Point.

Diagnostic Tools & PC Maintenance: Virus and its types, Effect of Virus for Computer System, Scanning and Antivirus remover tools, Antivirus Utilities for Diagnostic, Safety and Preventive Maintenance Tools, Data Recovery, PC care and Maintenance, Electrical Power Issues, O/S Troubleshooting issues in computer System

Basic Network Introduction & Installation: Introduction About Network, Installing Network Operating System Windows 2003 Server and Windows 2008 Server, Network Sharing and user Permission, Internet Connection, E-Mail, Cloud Networking, Google Drive, SkyDrive, Dropbox.

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:

1. A VHDL Primer – J. Bhasker, Prentice Hall, 1999, III Edition.
2. Verilog HDL-A guide to digital design and synthesis-Samir Palnitkar, Pearson, 2nd edition.

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:

1. Printed circuit Board – Design & Technology by Walter C. Bosshart, Tata McGraw Hill.
2. Printed Circuit Board –Design, Fabrication, Assembly & Testing by R.S.Khandpur, TATA McGraw Hill Publisher

Robotics
(Credits: 02)

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 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

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

Suggested Books:

1. Saha, S.K., Introduction to Robotics, 2nd Edition, McGraw-Hill Education, New Delhi, 2014
2. R.K. Mittal, I.J. Nagrath, “Robotics & Control”, Tata McGraw & Hills, 2005.

Mobile Application Programming
(Credits: 02)

Total Lectures 60

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

Android Development Environment: What is Android, Advantages and Future of Android, Tools and about Android SDK, Installing Java, Eclipse, and Android, Android Software Development Kit for Eclipse, Android Development Tool: Android Tools for Eclipse, AVDs: Smartphone Emulators, Image Editing,

Android Software Development Platform: Understanding Java SE and the Dalvik Virtual Machine, Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML, Screen Sizes, Launching Your Application: The AndroidManifest.xml File, Creating Your First Android Application

Android Framework Overview: The Foundation of OOP, The APK File, Android Application Components, Android Activities: Defining the User Interface, Android Services: Processing in the Background, Broadcast Receivers: Announcements and Notifications, Content Providers: Data Management, Android Intent Objects: Messaging for Components, Android Manifest XML: Declaring Your Components

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
4. Beginning Windows 8 Application Development, IstvánNovák, ZoltanArvai, György Balássy and David Fulop
5. Professional Windows 8 Programming: Application Development with C# and XML, Allen Sanders and Kevin Ashley, WroxPublication
6. Programming with Mobile Applications: Android, iOS, and Windows Phone 7 , Thomas Duffy, Course Technology, Cengage Learning 2013