Syllabus for B.Sc. Electronics (General and Honours) Degree Program under CBCS w.e.f 2017-18

Table I: Course Structure of B.Sc. General Degree Program

Sr.No	Semester	Course Code	Subject Title	Credits (T+P)
1.	I	DSC 1A	Network Analysis and Analog Electronics	4+2
2.	II	DSC 1B	Linear and Digital Integrated Circuits	4+2
3.	III	DSC 1C	Communication Electronics	4+2
4.	IV	DSC 1D	Microprocessor and Microcontrollers	4+2
5.	V (any one to be offered)	DSE 1A	Computer Networks and Administration	4+2
6.			Embedded Systems	4+2
7.			Biomedical and Pharmaceutical Instrumentation	4+2
8.			Electronics Instrumentation	4+2
9.	VI (any one to be offered)	DSE 1B	Photonics	4+2
10.			Power Electronics	4+2
11.			HDL and FPGA	4+2
12.			Industrial Automation	4+2

Table II: Course Structure of B.Sc. Honours Degree Program

Sr.No	Semester	Course Code	Subject Title	Credits (T+P)
1.	I	DSC 1	Network Analysis and Analog Electronics	4+2
2.	I	DSC 2	Mathematics Foundation for Electronics	4+2
3.	I	DSC 3	C Programming	4+2
4.	II	DSC 4	Linear and Digital Integrated Circuits	4+2
5.	II	DSC 5	Applied Physics	4+2
6.	II	DSC 6	Photonics	4+2

7.	III	DSC 7	Communication Electronics	4+2
8.	III	DSC 8	Transducers and Instrumentation	4+2
9.	III	DSC 9	Power Electronics	4+2
10.	IV	DSC 10	Microprocessors and Microcontrollers	4+2
11.	IV	DSC 11	Control system	4+2
12.	IV	DSC 12	Operating Systems and RTOS	4+2
13.	V	DSC 13	Embedded Systems	4+2
14.	V	DSE 1	Industrial Automation	4+2
15.	V	DSE 2	Biomedical and Pharmaceutical Instrumentation	4+2
16.	VI	DSC 14	Computer Networks and Administration	4+2
17.	VI	DSE 3	HDL and FPGA	4+2
18.	VI	DSE 4	Electronic project	4+2

Table III: Skill Enhancement Courses (SEC)

Sr. No.	Course Code	Subject Title	Credits (T+P)
1	SEC 1	Design and Fabrication of PCB	4+2
2	SEC 2	Programming with SciLab/Matlab	4+2
3	SEC 3	Programming with Python	4+2
4	SEC 4	Smart Phone Apps Development	4+2

Table IV: General Elective papers (GE)

Sr. No.	Course Code	Subject Title	Credits (T)
1.	GE 1	Electronics circuits and PCB designing	4
2.	GE 2	Basics of Robotics	4
3.	GE 3	Smart Phone Apps Development	4
4.	GE 4	CCTV Installation and Networking	4
5.	GE 5	Repair and Maintenance of Electrical and Electronic Appliances	4

CBSC SYLLABUS FOR B.Sc. GENERAL PROGRAM

(Numbers on right indicate number of lectures of 1 hour duration)

First Year B. Sc.

Semester I

ELECTRONICS-DSC 1A: NETWORK ANALYSIS AND ANALOG ELECTRONICS
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Circuit Analysis: **(14 Lectures)**

Concept of Voltage and Current Sources. Kirchhoff's Current Law, Kirchhoff's Voltage Law. Mesh Analysis. Node Analysis. Star and Delta networks, Star-Delta Conversion. Principal of Duality. Superposition Theorem. Thevenin's Theorem. Norton's Theorem. Reciprocity Theorem. Maximum Power Transfer Theorem. Two Port Networks: h, y and z parameters and their conversion

Junction Diode and its applications: **(18 Lectures)**

PN junction diode (Ideal and practical)-constructions, Formation of Depletion Layer, Diode Equation and I-V characteristics.Idea of static and dynamic resistance, dc load line analysis, Quiescent (Q) point. Zenerdiode, Reverse saturation current, Zener and avalanche breakdown. Qualitative idea ofSchottky diode. Rectifiers- Half wave rectifier, Full wave rectifiers (center tapped andbridge), circuit diagrams, working and waveforms, ripple factor and efficiency. Filter-Shunt capacitor filter, its role in power supply, output waveform, and working.Regulation- Line and load regulation, Zener diode as voltage regulator, and explanation for load and line regulation.

Bipolar Junction Transistor: . **(5 Lectures)**

Review of the characteristics of transistor in CE and CB configurations, Regions of operation (active, cut off and saturation), Current gains α and β. Relations between α and β. dc load line and Q point.

Amplifiers **(10 Lectures)**

Transistor biasing and Stabilization circuits- Fixed Bias and Voltage Divider Bias. Thermal runaway, stability and stability factor S. Transistor as a two port network, h-parameter equivalent circuit. Small signal analysis of single stage CE amplifier. Input and Output impedance, Current and Voltage gains. Class A, B and C Amplifiers.

Cascaded Amplifiers: **(2 Lectures)**

Two stage RC Coupled Amplifier and its Frequency Response.

Feedback in Amplifiers: **(2 Lectures)**
Concept of feedback, negative and positive feedback, advantages of negative feedback (Qualitative only).

Sinusoidal Oscillators: **(5 Lectures)**
Barkhausen criterion for sustained oscillations. Phase shift and Colpitt's oscillator. Determination of Frequency and Condition of oscillation.

Unipolar Devices: **(4 Lectures)**
JFET. Construction, working and I-V characteristics (output and transfer), Pinchoff voltage. UJT, basic construction, working, equivalent circuit and I-V characteristics.

Reference Books:

1. Electric Circuits, S. A. Nasar, Schaum's outline series, Tata McGraw Hill (2004)
2. Electrical Circuits, M. Nahvi & J. Edminister, Schaum's Outline Series, Tata McGraw-Hill (2005)
3. Electrical Circuits, K.A. Smith and R.E. Alley, 2014, Cambridge University Press
4. Network, Lines and Fields, J.D.Ryder, Prentice Hall of India.
5. Electronic Devices and Circuits, David A. Bell, 5th Edition 2015, Oxford University Press.
6. Electronic Circuits: Discrete and Integrated, D.L. Schilling and C. Belove, Tata McGraw Hill
7. Electrical Circuit Analysis, Mahadevan and Chitra, PHI Learning
8. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford University Press.
9. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
10. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)

Laboratory experiments under DSC 1A

At Least 15 Experiments From The Following

1. To familiarize with basic electronic components (R, C, L, diodes, transistors), digital Multimeter, Function Generator and Oscilloscope.
2. Measurement of Amplitude, Frequency & Phase difference using Oscilloscope.
3. Verification of (a) Thevenin's theorem and (b) Norton's theorem.
4. Verification of (a) Superposition Theorem and (b) Reciprocity Theorem.
5. Verification of the Maximum Power Transfer Theorem.
6. Study of the I-V Characteristics of (a) p-n junction Diode, and (b) Zener diode.
7. Study of (a) Half wave rectifier and (b) Full wave rectifier (FWR).
8. Study the effect of (a) C- filter and (b) Zener regulator on the output of FWR.
9. Study of the I-V Characteristics of UJT and design relaxation oscillator..
10. Study of the output and transfer I-V characteristics of common source JFET.

11. Study of Fixed Bias and Voltage divider bias configuration for CE transistor.
12. Design of a Single Stage CE amplifier of given gain.
13. Study of the RC Phase Shift Oscillator.
14. Study the Colpitt`s oscillator.
15. Construction of class A amplifier.
16. Construction of class B amplifier.
17. Construction of class C amplifier.
18. Study of Bridge rectifier.
19. Input and output characteristics of transistor in CE mode.
20. Use of diode as cliper.

Reference Books:

1. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata
2. McGraw-Hill (2005)
3. Networks, Lines and Fields, J.D.Ryder, Prentice Hall of India.
4. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
5. Allen Mottershead, Electronic Devices and Circuits, Goodyear Publishing Corporation.

Semester II

ELECTRONICS-DSC 1B: LINEAR AND DIGITAL INTEGRATED CIRCUITS
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Operational Amplifiers (Black box approach): (**5 Lectures**)
Characteristics of an Ideal and Practical Operational Amplifier (IC 741), Open and closed loop configuration, Frequency Response. CMRR. Slew Rate and concept of Virtual Ground.

Applications of Op-Amps: (**12 Lectures**)
(1) Inverting and non-inverting amplifiers, (2) Summing and Difference Amplifier, (3) Differentiator, (4) Integrator, (5) Wein bridge oscillator,(6) Comparator and Zero-crossing detector, and (7) Active low pass and high pass Butterworth filter (1st order only).

Number System and Codes: (**9 Lectures**)
Decimal, Binary, Octal and Hexadecimal number systems, base conversions. Representation of signed and unsigned numbers, BCD code. Binary,octal and hexadecimal arithmetic; addition, subtraction by 2's complement method,multiplication.

Logic Gates and Boolean algebra: (**4 Lectures**)
Truth Tables of OR, AND, NOT, NOR, NAND,XOR, XNOR, Universal Gates, Basic postulates and fundamental theorems of Boolean algebra.

Combinational Logic Analysis and Design: (**5 Lectures**)
Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP).

Arithmetic Circuits: (**3 Lectures**)
Binary Addition. Half and Full Adder. Half and Full Subtractor, 4- bit binary Adder/Subtractor.

Data processing circuits: (**3 Lectures**)
Multiplexers, De-multiplexers, Decoders, Encoders.

Clock and Timer (IC 555): (**3 Lectures**)
Introduction, Block diagram of IC 555, Astable and Monostable multivibrator circuits.

Sequential Circuits: SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. Master-slave JK Flip-Flop. (**6 Lectures**)

Shift registers: (2 **Lectures**)
Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).

Counters (4 bits): (**4 Lectures**)
Ring Counter. Asynchronous counters, Decade Counter.Synchronous Counter.

D-A and A-D Conversion: (**4 Lectures**)
4 bit binary weighted and R-2R D-A converters, circuit and working. Accuracy and Resolution. A-D conversion characteristics, successive approximation ADC. (Mention of relevant ICs for all).

Reference Books:
1.OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
2.Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, 2011, Oxford University Press.
3.Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011, Tata McGraw
4.Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
5.Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
6.Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning.
7.Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
8.R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)

Laboratory experiments under DSC 1B
At least 05 experiments each from section A, B and C
Section-A: Op-Amp. Circuits (Hardware)
1. To design an inverting amplifier using Op-amp (741,351)for dc voltage of given gain
2. (a) To design inverting amplifier using Op-amp (741,351) & study its frequency response
(b) To design non-inverting amplifier using Op-amp (741,351) & study frequency response
3. (a) To add two dc voltages using Op-amp in inverting and non-inverting mode
(b) To study the zero-crossing detector and comparator.
4. To design a precision Differential amplifier of given I/O specification using Op-amp.
5. To investigate the use of an op-amp as an Integrator.
6. To investigate the use of an op-amp as a Differentiator.
7. To design a Wien bridge oscillator for given frequency using an op-amp.
8. To design a circuit to simulate the solution of simultaneous equation and
1^{st} /2^{nd} order differential equation.
9. Design a Butterworth Low Pass active Filter (1st order) & study Frequency Response
10. Design a Butterworth High Pass active Filter (1st order) & study Frequency Response
11. Design a digital to analog converter (DAC) of given specifications.
Section-B: Digital circuits (Hardware)
1. (a) To design a combinational logic system for a specified Truth Table.

(b) To convert Boolean expression into logic circuit & design it using logic gate ICs.
(c) To minimize a given logic circuit.
2. Half Adder and Full Adder.
3. Half Subtractor and Full Subtractor.
4. 4 bit binary adder and adder-subtractor using Full adder IC.
5. To design a seven segment decoder.
6. To design an Astable Multivibrator of given specification using IC 555 Timer.
7. To design a Monostable Multivibrator of given specification using IC 555 Timer.
8. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
9. To build JK Master-slave flip-flop using Flip-Flop ICs
10. To build a Counter using D-type/JK Flip-Flop ICs and study timing diagram.
11. To make a Shift Register (serial-in and serial-out) using D-type/JK Flip-Flop ICs.

Section-C: SPICE/MULTISIM simulations for electronic circuits and devices

1. To verify the Thevenin and Norton Theorems.
2. Design and analyze the series and parallel LCR circuits
3. Design the inverting and non-inverting amplifier using an Op-Amp of given gain
4. Design and Verification of op-amp as integrator and differentiator
5. Design the 1storder active low pass and high pass filters of given cutoff frequency
6. Design a Wein`s Bridge oscillator of given frequency.
7. Design clocked SR and JK Flip-Flop`s using NAND Gates
8. Design 4-bit asynchronous counter using Flip-Flop ICs
9. Design the CE amplifier of a given gain and its frequency response.

Reference Books

1. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011,
2. Tata McGraw
3. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edn., 2000, Prentice Hall
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
5. Digital Electronics, S.K. Mandal, 2010, 1st edition, McGraw Hill

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Semester III

ELECTRONICS- DSC 1C: COMMUNICATION ELECTRONICS
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Electronic communication: (8 Lectures)
Introduction to communication – means and modes. Need for modulation. Block diagram of an electronic communication system. Brief idea of frequency allocation for radio communication system in India (TRAI). Electromagnetic communication spectrum, band designations and usage. Channels and base-band signals. Concept of Noise, signal-to-noise (S/N) ratio.

Analog Modulation: **(12 Lectures)**
Amplitude Modulation, modulation index and frequency spectrum. Generation of AM (Emitter Modulation), Amplitude Demodulation (diode detector), Concept of Single side band generation and detection. Frequency Modulation (FM) and Phase Modulation (PM), modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM using VCO, FM detector (slope detector), Qualitative idea of Super heterodyne receiver

Analog Pulse Modulation: **(9 Lectures)**
Channel capacity, Sampling theorem, Basic Principles-PAM, PWM, PPM, modulation and detection technique for PAM only, Multiplexing.

Digital Pulse Modulation: **(10 Lectures)**
Need for digital transmission, Pulse Code Modulation, Digital Carrier Modulation Techniques, Sampling, Quantization and Encoding. Concept of Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), and Binary Phase Shift Keying (BPSK).

Introduction to Communication and Navigation systems: (10 Lectures)
Satellite Communication– Introduction, need, Geosynchronous satellite orbits, geostationary satellite advantages of geostationary satellites. Satellite visibility, transponders (C - Band), path loss, ground station, simplified block diagram of earth station. Uplink and downlink.

Mobile Telephony System – **(10 Lectures)**
Basic concept of mobile communication, frequency bands used in mobile communication, concept of cell sectoring and cell splitting, SIM number, IMEI number, need for data encryption, architecture (block diagram) of mobile communication network, idea of GSM, CDMA, TDMA and FDMA technologies, simplified block diagram of mobile phone handset, 2G, 3G and 4G concepts (qualitative only).
GPS navigation system (qualitative idea only) **(1 Lecture)**

Reference Books:

1. Electronic Communications, D. Roddy and J. Coolen, Pearson Education India.
2. Advanced Electronics Communication Systems- Tomasi, 6th edition, Prentice Hall.
3. Modern Digital and Analog Communication Systems, B.P. Lathi, 4th Edition, 2011, Oxford University Press.
4. Electronic Communication systems, G. Kennedy, 3rd Edn., 1999, Tata McGraw Hill.
5. Principles of Electronic communication systems – Frenzel, 3rd edition, McGraw Hill
6. Communication Systems, S. Haykin, 2006, Wiley India
7. Electronic Communication system, Blake, Cengage, 5th edition.
8. Wireless communications, Andrea Goldsmith, 2015, Cambridge University Press

Laboratory experiments under -DSC 1C

AT LEAST 15 experiments

1. Amplitude modulation and demodulation.
2. Frequency modulation and demodulation.
3. Analog multiplexer
4. Sample and Hold Circuit.
5. Study of super heterodyne radio receiver.
6. DSB generation using IC 1596
7. V-F and F –V using IC 331
8. Study of Antennas
9. Study of Varactor diode modulator
10. Study of PLL.
11. Characteristic impedance of Transmission lines.
12. Pre-emphasis and De-emphasis
13. Generation of PWM using **555** timer.
14. Generation of PPM using **555** timer.
15. Generation of PAM
16. Study of PCM generation and detection.
17. Study of TDM
18. Study of FDM
19. Generation of ASK
20. Generation of FSK
21. Generation of PSK
22. Study of DPCM modulation.
23. Study of Delta Modulation
24. Study of Modem interfacing and configuration for data communication.

Reference Books:

1. Electronic Communication systems, G. Kennedy, 1999, Tata McGraw Hill.
2. Electronic Communication system, Blake, Cengage, 5th edition.
3. Electronic Communication: By Dennis Roddy and John Coolen, Prentice Hall of India, New Delhi, 4th Edition, 1998.

4. Electronic Communications Systems, Wayne Tomasi, 5th Edition Pearson Education
5. Digital Communications, Simon Haykins, John Wiley, 1988
6. Digital Communication, John.G .Proakis, Mc Graw Hill Inc., Third edition, Malaysia,
7. Digital Communication Techniques, Signal Design & Detection, M.K.Simen, Prentice Hall of India, 1999

Semester IV

ELECTRONICS-DSC 1D: MICROPROCESSOR AND MICROCONTROLLER
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Microcomputer Organization: **(5 Lectures)**
Input/Output Devices. Data storage (idea of RAM and ROM). Computer memory. Memory organization & addressing. Memory Interfacing. Memory Map.

8085 Microprocessor Architecture: (8 Lectures)
Main features of 8085. Block diagram. Pin-out diagram of 8085. Data and address buses. Registers. ALU. Stack memory. Program counter.

8085 Programming : (10 Lectures)
Instruction classification, Instructions set (Data transfer including stacks. Arithmetic, logical, branch, and control instructions). Subroutines, delay loops.
Timing & Control circuitry. Timing states. Instruction cycle, Timing diagram of MOV and MVI. Hardware and software interrupts.

8051 microcontroller: (12 Lectures)
Introduction and block diagram of 8051 microcontroller, architecture of 8051, overview of 8051 family, 8051 assembly language programming, Program Counter and ROM memory map, Data types and directives, Flag bits and Program Status Word (PSW) register, Jump, loop and call instructions.

8051 I/O port programming: (5 Lectures)
Introduction of I/O port programming, pin out diagram of 8051 microcontroller, I/O port pins description & their functions, I/O port programming in 8051 (using assembly language), I/O programming: Bit manipulation.

8051 Programming: (15 Lectures)
8051 addressing modes and accessing memory locations using various addressing modes, assembly language instructions using each addressing mode, arithmetic and logic instructions, 8051 programming in C: for time delay & I/O operations and manipulation, for arithmetic and logic operations, for ASCII and BCD conversions.

Introduction to embedded system: (5 Lectures)
Embedded systems and general purpose computer systems. Architecture of embedded system. Classifications, applications and purpose of embedded systems.

Reference Books:

1. Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall.
2. Embedded Systems: Architecture, Programming & Design, Raj Kamal, 2008, Tata McGraw Hill
3. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A.
4. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.
5. Microprocessor and Microcontrollers, N. Senthil Kumar, 2010, Oxford University Press
6. 8051 microcontrollers, Satish Shah, 2010, Oxford University Press.
7. Embedded Systems: Design & applications, S.F. Barrett, 2008, Pearson Education India
8. Introduction to embedded system, K.V. Shibu, 1st edition, 2009, McGraw Hill
9. Embedded Microcomputer systems: Real time interfacing, J.W. Valvano 2011, Cengage Learning
10. Exploring C for Microcontroller , J.S.Parab etal….Springer

Laboratory experiments under -DSC 1D

At least 7 experiments from Section-A and 8 from Section-B

Section-A: Programs using 8085 Microprocessor

1. Addition and subtraction of numbers using direct addressing mode
2. Addition and subtraction of numbers using indirect addressing mode
3. Multiplication by repeated addition.
4. Division by repeated subtraction.
5. Handling of 16-bit Numbers.
6. Use of CALL and RETURN Instruction.
7. Block data handling.
8. Other programs (e.g. Parity Check, using interrupts, etc.).
9. Sorting
10. Motor control

Section-B: Experiments using 8051 microcontroller:

1. To find that the given numbers is prime or not.
2. To find the factorial of a number.
3. Write a program to make the two numbers equal by increasing the smallest number and decreasing the largest number.
4. Use one of the four ports of 8051 for O/P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's .
5. Program to glow the first four LEDs then next four using TIMER application.
6. Program to rotate the contents of the accumulator first right and then left.
7. Program to run a countdown from 9-0 in the seven segment LED display.
8. To interface seven segment LED display with 8051 microcontroller and display 'HELP' in the seven segment LED display.
9. To toggle '1234' as '1324' in the seven segment LED display.

10. Interface stepper motor with 8051 and write a program to move the motor through a given angle in clock wise or counter clockwise direction.
11. Application of embedded systems: Temperature measurement & display on LCD

Reference Books:

1. Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall.
2. Embedded Systems: Architecture, Programming & Design, Raj Kamal, 2008, Tata McGraw Hill
3. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A.
4. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.
5. 8051 microcontrollers, Satish Shah, 2010, Oxford University Press.
6. Embedded Microcomputer systems: Real time interfacing, J.W. Valvano 2011, Cengage Learning.

Semester V

ELECTRONICS-DSE 1A: COMPUTER NETWORKS AND ADMINISTRATION
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Computer hardware: **3**
Introduction to Computer components and peripherals, BIOS, PC Assembling, Formatting and Installation of Operating System. Installing Drivers, Installing Application Software, Troubleshooting.

PHYSICAL LAYER **4**
Data Communications, Networks, Network types, Protocol, layering, OSI model, Layers in OSI model, TCP / IP protocol suite, Addressing, Guided and Unguided Transmission media. Switching: Centralized switching, store and forward, circuit switching, packet switching, network protocols- protocol phases, poling protocols, contention protocols,

DATA LINK LAYER **4**
Introduction to Data link Layer, DLC Services, DLL protocols, HDLC, PPP, Media Access Control: Random Access, Controlled Access, Channelization. Wired LAN: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Giagabit Ethernet, 10 Gigabit Ethernet.

Wireless LANS & Virtual Circuit Networks **4**
Introduction, Wireless LANS: IEEE 802.11 project, Bluetooth, Zigbee, Connecting devices and Virtual LANS: Connecting devices, Virtual LANS.

Network Layer **4**
Network Layer Services, Packet Switching, Network layer performance, IPv4, addresses, Forwarding of IP packets, Network layer protocols: IP, ICMPv4, Mobile IP, Unicast Routing: Introduction, Routing Algorithms, Unicast Routing protocols, Multicast Routing Introduction, Next Generation IP:IPv6 Addressing, The IPv6 protocol, ICMPv6, Transition from IPv4 to IPv6.

Transport Layer **3**
Introduction, Transport layer protocols and services, Port numbers User Datagram Protocol (UDP), Transmission Control protocol (TCP), SCTP, Quality of services: Dataflow characteristics, Flow Control.

Application Layer **4**
Introduction, World Wide Web and HTTP, FTP, Electronic mail, Telnet, Name System (DNS), Cryptography and Network Security: Introduction, Symmetric key ciphers and Asymmetric key Ciphers, Introduction to network security.

Basics terms of server **3**

Introduction to the concepts of Users, Groups and Computer management, Group policy Infrastructures and Group Policy Settings, Authentication, Domain Controllers, Sites and Replication, Domains and Forests

MS WINDOWS SERVER 2012 R2

Introduction **3**

Windows server editions, Desktop changes, active directory changes, Virtualization, network changes, management tools, file and print sharing, web based services

Installation and upgrading to Windows 2012 R2 server **2**

Installing the operating system using server manager to configure services, installing a sample server network.

Introduction to server core: **5**

Installing server core, configurations of server core, configuring roles and features

Windows server 2012 R2 Networking Enhancements **3**

Benefits of IPv6, networking managebility with power shell, Microsoft NIC teaming, Enhanced QoS.

IP address management **5**

IPAM: IPAM REQUIREMENTS, IPAM components, IPAM installation: installing the IPAM server feature, installing the IPAM client feature, configuring IPAM Provisioning and server Discovery, Run Server Discoveries, Choosing Servers for management and retrieving data,

DNS & Name resolution in windows server 2012 R2 **5**

Installing DNS, Configuring standalone DNS server, integrating with other DNS servers, implementing zones to manage namespaces, understanding record types, Managing DNS clients and name resolutions, understanding active directory's DNS,configuring DNS automatically,

Creating & managing user accounts **2**

Creating local user accounts, creating domain user accounts, setting local user account properties, setting domain based user account properties.

Group policy **2**

Group policy concepts, Gropu policy basics, local policies and group policy objects.

Files ,folders and basic shares **2**

Understanding the file and storage server roles, creating shares,managing permissions

Creating & managing shared folders: **1**

Creating shared folders , managing permissions

Sharing printers on windows server 2012 R2 networks **1**

Print services overview, installing the print and docum,ent services role

Reference Books:

1. Computer Networks By A. Tennaunbaum.
2. Mastering Windows Server® 2012R2 By: Mark Minasi; Darril Gibson; Aidan Finn; Wendy Henry; Byron Hynes Publisher: Sybex

Laboratory experiments under:DSE 1A

At Least 15 Experiments From The Following

1. Assembling the pc
2. Formatting and installation of OS
3. Troubleshooting general system problems
4. Study of network devices: repeater, hub, router, bridge, switch, gateway,etc.
5. Study of IP networking and subnetting
6. Crimping and punching of network cables(straight and crossed)
7. Setting up of a network in a lab
8. Configuring Domain Controller
9. Managing users, computers and groups on a domain controller
10. Implementation of group policies
11. Configuring DNS and DHCP roles
12. WSUS implementation
13. Windows deployment
14. Configuring Wireless Network
15.simple Chat Program using TCP Sockets
16. Simulation of HTTP Protocol using TCP Sockets
17. Simulation of DNS using UDP Sockets
18. Learn to use commands like TCP Dump, Netstat, Trace Route
19. Simulation of Ping using Raw Sockets 64
20. Simulation of Distance Vector/ Link State Routing algorithm
21. Study and configure functionalities of a router and switches (or by simulation)
22. Study of TCP/UDP performance using Simulation tool
23. Performance comparison of Routing protocols using Simulation tool
24. Simulation of error correction code (like CRC)

Reference Books

1. Computer Networks by A. Tennaunbaum.
2. Mastering Windows Server® 2012R2 By: Mark Minasi; Darril Gibson; Aidan Finn; Wendy Henry; Byron Hynes Publisher: Sybex

ELECTRONICS-DSE 1A: EMBEDDED SYSTEMS
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

UNIT 1: **10**

Introduction to Microcontroller / Microprocessor architectures

1. The Texas Instrument's MSP430 Microcontrollers
    a. Architecture
        i. CPU
        ii. Memory Structure
        iii. RAM and Information memory
        iv. Variants and their hardware enhancements

UNIT 2: **10**

1. Resets and Interrupts
    a. Resets
    b. Interrupts and its uses
    c. Interrupt v/s Polling
2. Clocks and Timers
    a. Sources
    b. Controls
3. Low power design
    a. Power Consumption characteristics
    b. Low Power modes
4. Addressing modes
    a. Register mode
    b. Immediate mode
    c. Absolute mode
    d. Indirect mode/ Indirect Auto-increment mode

UNIT 3: **20**

Serial communication interfaces

a. UART
b. I2C
c. SPI

1. Instruction set of MSP430
    a. Basic Instruction set

b. I/O Port programming
c. Arithmetic & Logical Instructions

UNIT 4: **20**

Real time interfacing (I)

a. 16x2 Alphanumeric LCD
b. 4 x 1 / 4x4 keypad
c. 7segment LED
d. RTC

2. Real time Interfacing – (II) Mixed signal interfaces
   a. 10bit /12 bit SAR A/D converter
   b. 16bit / 24bit Sigma Delta A/D converter
   c. 12 bit D/A Converter
3. Real time interfaces III (Communication of data)
   a. UART
   b. I2C
   c. SPI

Note: Examples in Assembly & C is workable on IAR WORKBENCH

Reference Books:

1. Embedded Systems Design using the TI MSP430 Series Author: Chris Nagy Imprint Newnes
2. MSP430 Microcontroller Basics Author: John Davies Imprint: Newnes
3. User data manuals and Hankbooks of TI MSP430

Laboratory experiments under -DSE 1A: EMBEDDED SYSTEMS

At Least 15 Experiments From The Following

1. Lab-1 (4 – experiments)

Basic Instruction set

i. I/O Port programming
ii. Addressing modes
iii. Arithmetic & Logical Instructions
iv. RAM and Information memory

2. Lab-2 (2 – experiments)

Timers of MSP430

3. Lab-3 (2 – experiments)

Interrupts

4. Lab-4 (7 – experiments)

Real time interfacing (I)

i. 16x2 Alphanumeric LCD
ii. 4 x 1 keypad
iii. 4 x 4 keypad
iv. 7segment LED
v. RTC
vi. Interfacing DC motor
vii. Interfacing STEPPER motor

5. Lab-5 (3 – experiments)

Real time Interfacing – (II) Mixed signal interfaces

i. 12bit A/D converter
ii. 16bit Sigma Delta A/D converter
iii. 12 bit D/A Converter

6. Lab-6 (3 – experiments)

Real time Interfacing – (III) Serial communication interfaces

i. UART
ii. I2C
iii. SPI

Examples in Assembly & C is workable on IAR WORKBENCH

Reference Books:

1. Embedded Systems Design using the TI MSP430 Series Author: Chris Nagy Imprint Newnes
2. MSP430 Microcontroller Basics Author: John Davies Imprint: Newnes
3. User data manuals and Hankbooks of TI MSP430

ELECTRONICS-DSE 1A: BIOMEDICAL AND PHARMACEUTICAL INSTRUMENTATION

(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Pharmaceutical Instrumentation: 06

Ph-meter: Analog & Digital Ph-meter, **Chromatograph:** Gas Chromatography, Liquid Chromatography, IR Spectrophotometers, Mass Spectrophotometer.

Chemical Sensors: 05

Field Effect Transducer (ISFET, IMFET), **Blood Glucose Sensor:** Glucose oxidase Enzyme, Optical Approach, **Oximeter:** Oximetry, **In-Vitro Oximetry:** Transmision Oximetry, Reflection Oximetry & In-Vivo oximetry.

Fundamentals of Medical Instrumentation: 06

Physiology system of body: Cardiovascular System, Respiratory System, Nervous system, Sources of Biomedical Signals, Basic Medical Instrumentation system, General constraints in design of medical instrumentation system.

Bioelectric Signals And Electrodes: 09

Origin of bioelectric potentials: Electrocardiogram, Electroencephalogram & Electromyogram, **Recording Electrodes:** Electrode Tissue Interface, **Skin contact impedance, Electrodes for ECG, Electrodes for EEG**, **Electrodes for EMG**, **Electrical conductivity of electrodes jellies and creams**, **Microelectrodes:** Glass micro capillary Electrode, Metal Micropipette.

Physiological Transducers: 06

Classification of Transducers, Performance Characteristics of Transducers: Static Characteristics and Dynamic Characteristics, Signals from Cardiovascular system, Signals from Respiratory system, Optical Fibre Sensors, Types of Optical Fibre Sensors, Various types of Transducers for biomedical Applications.

Biomedical Instruments: 14

Bio-medical recorders: Electrocardiography: Block diagram of Electrocardiography, ECG Leads, **Electroencephalography:** Block diagram of Electroencephalography, **Electromyography:** Block diagram of Electromyography, Measurement of Heart rate, Measurement of Pulse rate, **Blood Pressure Measurement**: **In-direct Blood Pressure measurement:** Automatic Blood Pressure Measuring using Korotkoffs Method, Oscillometric Method, **Measurement of Respiration rate:** Thermistor Method, Pulse Oximeter, **Blood Flow meters:** Electromagnetic blood flow meter, Chamber plethysmography, C**ardiac Pacemaker**: Asynchronous cardiac pacemaker, demand type synchronous pacemaker, An atrial- synchronous cardiac pacemaker.

Biotelemetry: **04**

Introduction to Biotelemetry, Physiological parameters, Adaptable to Biotelemetry, The components of Biotelemetry System, Implantable Units, Applications of telemetry in-Patient care.

The Laser Application In Biomedical Field: **04**

Laser: Pulse Ruby, ND-YAG, Helium-Neon, Argon, CO_2 LASER.

Non-Invasive Diagnostic Imaging: **06**

Study of block diagrams of X-Ray, Study of block diagrams of CT, Study of block diagrams of Nuclear Medical Imaging, Study of block diagrams of Magnetic Resonance Imaging, Study of block diagrams of Ultrasonic Imaging.

Reference Books:

1. Handbook of Analytical Instrumentation By R.S.Khandpur , TMH,2nd Edn
2. Handbook of Biomedical Instrumentation By R.S.Khandpur ,TMH,2nd Edn
3. Medical Instrumentation- Application & Design, By John Webster , 3rd Edition, Wiley India Edi.
4. Electronics Instrumentation by H. S. Kalsi , Tata Mc Graw Hill.
5. Instrumental methods of Chemical Analysis, E.W.Ewing
6. Biomedical Instrumentation and Measurements By Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer PHI(2nd Edition)

Laboratory experiments under DSE 1A LAB: BIOMEDICAL & PHARMACEUTICAL INSTRUMENTATION

AT LEAST 15 EXPERIMENTS FROM FOLLOWING.

1. Study of Bio-Medical ECG.
2. Study of Bio-Medical EEG.
3. Study of Bio-Medical EMG.
4. Study of Bio-Medical Electronics Pressure meter.
5. Study of Bio-Medical Glucometer.
6. Study of Cardiac Pacemaker.
7. Study of Ultrasonagraphy.
8. Study of Oximeter
9. Measurement of respiration rate using thermister.
10. Study of Bio-Medical transducers for bio-medical applications.
11. Bio-Medical application using transducer I.
12. Bio-Medical application using transducer II.

13. Study of electrical conductivity of electrodes and jellies / creams.
14. Construction of Analog Ph Meter using Opamp.
15. Construction of Pulse Rate Meter.
16. Construction of Heart beat Meter.
17. Measurement of Body Temperature using thermister.
18. Study of Gas Chromatography.
19. Study of Liquid Chromatography.
20. Study of VIS-IR Spectrometer.

Reference Books:

1. Handbook of Analytical Instrumentation By R.S.Khandpur , TMH,2nd Edn
2. Handbook of Biomedical Instrumentation By R.S.Khandpur ,TMH,2nd Edn
3. Medical Instrumentation- Application & Design, By John Webster , 3rd Edition, Wiley India Edi.
4. Electronics Instrumentation by H. S. Kalsi , Tata Mc Graw Hill.

ELECTRONICS-DSE 1A: ELECTRONICS INSTRUMENTATION

(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

QUALITIES OF MEASUREMENTS: 06

Introduction, Performance Characteristics, Static characteristics, Error in measurement, Types of Error, Sources of Error, Dynamic characteristics, Statistical analysis, Standard, Atomic frequency and time standards.

TRANSDUCERS: 15

Electrical transducer: Characteristics, advantages, Selecting a Transducer, **Resistive Transducer:** Potentiometer, Resistance pressure transducer, Resistive Position Transducer, Resistance thermometer. **Strain Gauges:** Resistance wire Gauge (Unbonded and Bonded), Foil strain Gauge, semiconductor strain Gauge. **Inductive transducer:** Change in self inductance with number of turns and with change in permeability, Variable reluctance type transducer, Differential output Transducer, LVDT, Pressure inductive transducer, Capacitive Transducer (pressure), Load cell (Pressure Cell), Piezo Electric Transducer, **Photoelectric transducer:** Photomultiplier tube, Photocells, Photo-Voltaic cell, Semiconductor Photodiode, Phototransistor.

Temperature Transducer: Thermocouple, Thermistor, RTD. Magnetic flow meters.

SIGNAL CONDITIONING: 08

Introduction, **Basic Instrumentation amplifier:** Instrumentation amplifier, Instrumentation system, Instrumentation amplifier using Transducer Bridge. Chopped and Modulated DC Amplifier. **Modulators:** Synchronous Modulator and Demodulator, Solid state Modulator/Demodulator Circuit. **Types of Active filters:** Butterworth, Chebyschev, Bessel & Elliptic.

OSCILLOSCOPE: 10

Basic principle, Block diagram of oscilloscope, **Types of CRO:** Principles of Dual beam and Dual trace Oscilloscope, Analog storage Oscilloscope, DSO, Powerscope: Block diagram, principle and working, Advantages and applications, CRO specifications (bandwidth, sensitivity, rise time).

BRIDGES: 05

DC Bridges and applications: Wheatstone, Kelvin, AC Bridges: General form of AC bridge balance, comparison bridges, Maxwell, Hay, Schering, Wien, LCR Bridge.

SIGNAL GENERATOR: 03

A.F Sine & Square Wave Generator, Function generator, Pulse Generator, Sweep Frequency generator.

WAVE ANALYZERS: 05

Basic wave analyzer, Frequency Selective Wave Analyzer, Heterodyne Wave Analyzers. Harmonic Distortion Analyzers, Spectrum Analyzers.

DIGITAL INSTRUMENTS: 08

Digital Voltmeters: Ramp type DVM, Dual Slope integrating type DVM, Staircase Ramp Type, Successive Approximation DVM, 31/2 Digit, Resolution & Sensitivity of Digital Meters, Digital Multimeters, Digital Frequency meter.

Reference Books:

1. Electronics Instrumentation by H. S. Kalsi , 2nd Edition, Tata Mc Graw Hill, 2nd Edition
1. Industrial Instrumentation by K. Krishnaswami and S. Vijayachitra, New Age Int. Pub.
2. Measurement, Instrumentation and Experiment Design in Physics and Engineering by Michael Sayer and Abhai Mansingh, PHI Ltd, 2008

Laboratory experiments under -DSE 1A ELECTRONICS INSTRUMENTATION

Atleast 15 experiments

1. Instrumentation amplifiers.
2. Temperature control using thermistor.
3. LVDT displacement sensor.
4. Ultrasonic sensor for ranging.
5. Characteristics of a Phototransistor.
6. Characteristics of Photocell and its application.
7. Interfacing of solar panel for lighting application.
8. Generation of sine and triangle using XR-2206.
9. Generation of waveforms using 8038.
10. Intruder alarm using photodiode and opamp.
11. Fluid level sensor using opamp.
12. Characteristics of thermocouple.
13. Design of Bessel/Chebyschev Filter.
14. Signal conditioning circuit.
15. Frequency measurement using Wein Bridge.
16. Frequency measurement using Maxwell's Bridge.
17. Frequency measurement using Wheatstone Bridge,
18. Frequency measurement using Kelvin's Bridge.
19. Frequency measurement using Hay's Bridge.
20. Frequency measurement using Schering Bridge.
21. Frequency measurement using LCR Bridge.

Reference Books:

1. Industrial Instrumentation by K. Krishnaswami and S. Vijayachitra, New Age Int. Pub.
2. Measurement, Instrumentation and Experiment Design in Physics and Engineering by Michael Sayer and Abhai Mansingh, PHI Ltd, 2008

Semester VI

ELECTRONICS-DSE 1B: PHOTONICS
(Credits: Theory-04, Practicals-02)
Theory Lectures 60

Unit-1 (22 Lectures)
Light as an Electromagnetic Wave: Plane waves in homogeneous media, concept of spherical waves. Reflection and transmission at an interface, total internal reflection, Brewster's Law. Interaction of electromagnetic waves with dielectrics: origin of refractive index, dispersion.
Interference : Superposition of waves of same frequency, Concept of coherence, Interference by division of wavefront, Young's double slit, Division of Amplitude, thin film interference, anti-reflecting films, Newton's rings; Michelson interferometer. Holography.
Diffraction: Huygen Fresnel Principle, Diffraction Integral, Fresnel and Fraunhoffer approximations. Fraunhoffer Diffraction by a single slit, rectangular aperture, double slit, Resolving power of microscopes and telescopes; Diffraction grating: Resolving power and Dispersive power

Unit-2 (13 Lectures)
Polarization: Linear, circular and elliptical polarization, polarizer-analyzer and Malus' law; Double refraction by crystals, Interference of polarized light, Wave propagation in uniaxial media. Half wave and quarter wave plates. Faraday rotation and electro-optic effect.

Unit-3 (13 Lectures)
Light Emitting Diodes: Construction, materials and operation.
Lasers: Interaction of radiation and matter, Einstein coefficients, Condition for amplification, laser cavity, threshold for laser oscillation, line shape function. Examples of common lasers. The semiconductor injection laser diode.
Photodetectors: Bolometer, Photomultiplier tube, Charge Coupled Device. Photo transistors and Photodiodes (p-i-n, avalanche), quantum efficiency and responsivity.
LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays, applications, advantages over LED displays.

Unit-4 (12 Lectures)
Guided Waves and the Optical Fiber: TE and TM modes in symmetric slab waveguides, effective index, field distributions, Dispersion relation and Group Velocity. Step index optical fiber, total internal reflection, concept of linearly polarized waves in the step index circular dielectric waveguides, single mode and multimode fibers, attenuation and dispersion in optical fiber.

Reference Books:

1. Ajoy Ghatak, Optics, Tata McGraw Hill, New Delhi (2005)
2. E. Hecht, Optics, Pearson Education Ltd. (2002)
3. J. Wilson and J. F. B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India (1996)
4. S. O. Kasap, Optoelectronics and Photonics: Principles and Practices, Pearson Education (2009)
5. Ghatak A.K. and Thyagarajan K., "Introduction to fiber optics," Cambridge Univ. Press. (1998)

Laboratory experiments under: DSE 1B: PHOTONICS

At least 15 experiments from following list

1. To verify the law of Malus for plane polarized light.
2. To determine wavelength of sodium light using Michelson's Interferometer.
3. To determine wavelength of sodium light using Newton's Rings.
4. To determine the resolving power and Dispersive power of Diffraction Grating.
5. Diffraction experiments using a laser.
6. Study of Faraday rotation.
7. Study of Electro-optic Effect.
8. To determine the specific rotation of scan sugar using polarimeter.
9. To determine characteristics of LEDs (Radiation pattern, Power Vs. Current)
10. To measure the numerical aperture of an optical fiber.
11. Design of Photo detector circuit using OP-amp
12. Design of digital optical receiver using comparator
13. To determine characteristics Photo- detector (rise time, radiation pattern, Power Vs. Current)
14. Light coupling in optical fiber, Numerical aperture of Fiber
15. Construction of Analog optical transmitter
16. Construction of Digital optical transmitter
17. Coupling efficiency in SMF and MMF fibers
18. Misalignment losses on fibers
19. Design of analog optical audio receiver
20. Comparioson of Laser diode with LEDs

Reference Books:

3. J. Wilson and J. F. B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India (1996)
4. S. O. Kasap, Optoelectronics and Photonics: Principles and Practices, Pearson Education (2009)
5. Ghatak A.K. and Thyagarajan K., "Introduction to fiber optics," Cambridge Univ. Press. (1998)

ELECTRONICS-DSE 1B: POWER ELECTRONICS
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Power Devices: (3L)
Need for Semiconductor Power Devices, Power Diodes, Introduction to Power semiconductor devices, Types of Power electronic converters.

Silicon Controlled Rectifier (SCR): (8L)
Structure, Principle of operation, V-I characteristics, Two- transistor model of SCR, turn-on and turn-off time, di/ dt and dv/dt ratings, factors affecting characteristics/ratings of SCR, Turn–on Methods of SCR, Gate firing circuits: Resistive, Resistive- Capacitive, UJT firing circuit, PUT firing circuit, Synchronized UJT firing circuit, Pulse transformer firing circuit and Light Activated firing circuit, SCR as a static switch.

Triac: .(2L)
Structure, Principle of operation, V-I characteristics, Comparison between SCR and Triac.Application of Diac and SBS as a triggering device for a Traic

Protection of Power Semiconductor Devices: (2L)
Overvoltage protection, overcurrent protection, Over temperature protection, Gate protection using shielding and RF filters, Snubber circuit.

Converters: (7L)
Single Phase Half wave controlled rectifier with resistive load and inductive load (qualitative study only), Effect of freewheeling diode**,** Single Phase Full wave controlled rectifier: Mid-point configuration and Bridge configuration with resistive load and inductive load, Single Phase Half controlled rectifier Bridge rectifier with resistive load and inductive load, DC link variable converter , Dual Converter without circulating current, Cycloconverter, AC voltage Stabilizer.

Power Transistor: (5L)
Power BJT: Circuit diagram, Switching Characteristics and limitations Power MOSFET: Circuit diagram, Output transfer characteristics, switching characteristics and limitations, IGBT: structure with equivalent circuit, State and dynamic characteristics, Comparison between Power BJT, Power MOSFET and IGBT.

Power Inverter: (10L)
Thyristor Turn- off Methods, Commutating circuits (working principle only), Introduction to Inverter, Basic circuit diagram of Voltage driven inverter, current driven inverter, sine wave inverter and square wave inverter, Thyristor Inverters: Centre- tapped load inverter, centre-tapped supply inverter, Bridge inverter, Current commutated bridge inverter, voltage commutated bridge inverter, McMurray inverter, McMurray- Bedford Inverter, Single Phase Pulse width Modulated inverter, Control of inverter output voltage, Current driven inverter, Series inverter: Basic series inverter (working principle only) and its drawbacks, Modified Series inverter, Uninterruptible Power Supply (UPS) : Types and Working principle(Blocks only).

Batteries: (2L)
Types of batteries used for Inverters, specification of batteries, Load calculation for batteries, connection of batteries and their Maintenance. Battery charger circuit.

Choppers: (6L)
Principle of a chopper, Step-down chopper, step-up chopper, step Up-Down chopper, Chopper classification (Type A-D), Thyristor chopper: Voltage and current commutated, Morgan Chopper, Jones Chopper.(qualitative study only)

PolyPhase and Coupled Circuits: (4L)
Poly phase system, advantages of Three Phase system, interconnection of Three Phase sources and loads, voltage Current and power in a Star and Delta connected system, Mutual inductance, characteristics of an ideal transformer and transformer losses.

DC Motors: (6L)
Basic understanding of field and armature, motor principle and motor action , Significance of the back e.m.f., torque and speed relation of a DC motor, Charcteristics of DC series and DC shunt motors, Electric Braking of DC motors. Thyristor based DC motor speed control.

AC Motors: (5L)
Classification of AC motors, Induction Motor**:** General Principle, Contruction, Production of rotating field: two phase supply, Why does the rotor rotate?, slip, frequency of rotor current, speed / torque characteristics of a AC motor, Thyristor based speed control of AC motor.

Reference Books:

1. Power Electronics and its applications by Alok Jain, Penram Intl. Pub. 2nd E
1. Power Electronics by MD Singh, KB Khanchandani. Tata McGraw 2nd Ed.
2. Circuits and Networks analysis and synthesis by Shudakar & ShyamMohan
3. A Text Book of electrical Technology Vol II by Theraja and Theraja

Laboratory experiments under -DSE 1B : POWER ELECTRONICS

At Least 15 Experiments From The Following

1. Study of I-V characteristics of a SCR
2. Study of I-V characteristics of a Triac
3. Study of I-V characteristics of a Power BJT
4. Study of I-V characteristics of a Power MOSFET
5. Study of I-V characteristics of a IGBT
6. Study of I-V characteristics of a Diac and SBS.
7. Study of Half wave controlled rectifier with resistive and inductive loads.
8. Study of Full wave controlled rectifier with resistive and inductive loads
9. Study of importance of freewheeling diode.

10. SCR based Power Controller using Resistive and Resistive Capacitive firing circuit.
11. SCR based Power Controller using UJT firing circuit.
12. SCR based Power Controller using PUT firing circuit
13. SCR based Power Controller using LASCR firing circuit
14. Application of thyristor as a Static switch
15. DC Motor control using SCR
16. AC motor control using SBS and Triac
17. Illumination control using Diac and Triac
18. AC voltage controller using Triac with synchronized UJT triggering.
19. Study of Snubber circuit
20. Study of forced Voltage Commutating Circuits
21. Study of forced Current Commutating Circuits
22. Study of Bridge inverter
23. Study of chopper circuit
24. Study of load calculation and connection of UPS for a given setup
25. Study of Stabilizer.
26. Study of UPS , assembling and disassembling
27. Construction of Transformer
28. Study of constructional features of DC and AC motors
29. Load characteristics of DC motor
30. Break test of induction motor.

Reference Books:

1. Power Electronics and its applications by Alok Jain, Penram Intl. Pub. 2nd E
2. Power Electronics by MD Singh, KB Khanchandani. Tata McGraw 2nd Ed

ELECTRONICS-DSE 1B: HDL AND FPGA
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Digital logic design flow: (**20 lectures**)

Review of combinational circuits. Combinational building blocks: multiplexors, demultiplexers, decoders, encoders and adder circuits. Review of sequential circuit elements: flip-flop, latch and register. Finite state machines: Mealy and Moore. Other sequential circuits: shift registers and counters. FSMD (Finite State Machine with Datapath): design and analysis. Microprogrammed control. Memory basics and timing. Programmable Logic devices.

Evolution of Programmable logic devices: (**20 lectures**)

PAL, PLA and GAL. CPLD and FPGA architectures. Placement and routing. Logic cell structure, Programmable interconnects, Logic blocks and I/O Ports. Clock distribution in FPGA. Timing issues in FPGA design. Boundary scan.

Verilog HDL: (**20 lectures**)

Introduction to HDL, Verilog primitive operators and structural Verilog Behavioral Verilog. Design verification. Modeling of combinational and sequential circuits (including FSM and FSMD) with Verilog Design examples in Verilog.

Reference Books:

1. LizyKurien and Charles Roth. *Principles of Digital Systems Design and VHDL.*Cengage Publishing. ISBN-13: 978-8131505748
2. Palnitkar, Samir, *Verilog HDL.* Pearson Education; Second edition (2003).
3. Ming-Bo Lin. *Digital System Designs and Practices: Using Verilog HDL and FPGAs.* Wiley India Pvt Ltd. ISBN-13: 978-8126536948
4. Zainalabedin Navabi. *Verilog Digital System Design.* TMH; 2ndedition. ISBN-13: 978-0070252219
5. Wayne Wolf. *FPGA Based System Design.* Pearson Education.
6. S. K. Mitra, Digital Signal processing, McGraw Hill, 1998
7. VLSI design, Debaprasad Das, 2nd Edition, 2015, Oxford University Press.
8. D.J. Laja and S. Sapatnekar, Designing Digital Computer Systems with Verilog, Cambridge University Press, 2015.

Laboratory experiments under -DSE 1B : HDL AND FPGA
AT LEAST 15 EXPERIMENTS FROM FOLLOWING.

1) Write code to realize basic and derived logic gates.
2) Design a Half adder, Full Adder using basic and derived gates.
3) Design a Half subtractor and Full Subtractor using basic and derived gates.
4) Design a 4 bit Adder.
5) Design a Multiplexer (4x1) using logic gates.
6) Design a Demultiplexer (1x4) using logic gates.
7) Design a Decoder using logic gates.
8) Design a Encoder using logic gates.
9) Design a Clocked JK (with Reset inputs)
10) Design a Clocked D and T Flip flops (with Reset inputs)
11) Design a 3-bit Ripple up counter/ 3-bit Ripple down counter
12) Design a 4 bit SISO (Serial in Serial Out)/ SIPO (Serial in Parallel Out)
13) Design a 4 bit PISO (Parallel in Serial Out) / PIPO (Parallel in Parallel Out)
14) Design a 4 bit shift Left Register/ Design a 4 bit Right shift Register
15) Design to blink LED (4 LED's)
16) Design and study switching circuits (LED blink shift)
17) Design traffic light controller.
18) Design to interface seven segment display.
19) Design to interface a stepper motor.
20) Design to interface a DC motor.

Reference Books:

1. LizyKurien and Charles Roth. *Principles of Digital Systems Design and VHDL.*Cengage Publishing. ISBN-13: 978-8131505748
2. Palnitkar, Samir, *Verilog HDL.* Pearson Education; Second edition (2003).
3. Ming-Bo Lin. *Digital System Designs and Practices: Using Verilog HDL and FPGAs.* Wiley India Pvt Ltd. ISBN-13: 978-8126536948
4. Zainalabedin Navabi. *Verilog Digital System Design.* TMH; 2ndedition. ISBN-13: 978-0070252219

ELECTRONICS-DSE 1B: INDUSTRIAL AUTOMATION
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Unit 1 (12 Lectures)
Single loop control, Centralized control, Distributed control systems, Open systems, SCADA systems, Types of data available, Data communication components and protocols.
Unit 2 (18 Lectures)
Programmable Logic Controllers (PLC), input/output systems, CPU, memory Unit, Programmer Units, Peripheral devices, Controller programming tools, Programming of PLCs, PLC Hardware Environment.
Unit 3 (10 Lectures)
Distributed Control Systems (DCS), PLC vs. DCS systems, Local control Units, dedicated card controllers, Unit Operations controllers, DCS multiplexers, DCS system integration.
Unit 4 (20 Lectures)
Supervisory Control and Data acquisition (SCADA) Systems, Types of supervisory systems, Distributed Digital Control Systems (DCS), Direct digital control (DDC), SCADA: Components of SCADA Systems, field data interface devices, communication network and other details, System Architecture: monolithic, distributed, networked, SCADA protocols in short, application of SCADA in industry; installation of SCADA Systems; security and weakness of SCADA Systems.

Reference Books
1. S. Gupta, JP Gupta, "PC interface For Data Acquiring & Process Control", 2nd Ed., Instrument Society of America.
2. John W. Web, Ronald A. Reis, "Programmable Logic Controllers" 5th Edition, PHI
3. Liptak, B. G. (E.d.), "Instrument Engineers Handbook", vol. I to III, Chilton Book Co.
4. Bhatkar, Marshal, "Distributed Computer control & Industrial Automation", Dekker Publication
5. Frank D. Petruzella, "Programmable Logic Controllers", 3rd Edition, McGraw Hill

Laboratory experiments under -DSE 1B: INDUSTRIAL AUTOMATION
At least 8 from PLC list and 7 from SCADA

PLC PRACTICALS:

1. INTERFACING OF FIELD DEVICES TO PLC, VIZ, SENSOR, RELAYS, PUSH BUTTONS AND UNDERSTANDING OF SOURCE AND SINK CONCEPT.

2. USE OF "NO" AND "NC" CONTACTS FOR WRITING EFFECTIVE "START" AND "STOP" CIRCUIT.

3. USE OF LADDER DIAGRAM TO UNDERSTAND NORMALLY CLOSE CONTACT AS "FAIL SAFE CONTACT".

4. CONCEPT OF INTERLOCKING FOR SAFE MACHINE OPERATION.

5. IMPORTANCE OF LATCH , JOG / INCHING.

6. UNDERSTANDING THREE BASIC TIMERS : ON DELAY, OFF DELAY AND RETENTIVE.
(USING TIMER BASED APPLICATIONS)

7. UNDERSTANDING TWO COUNTERS UP AND DOWN (USING COUNTER BASED APPLICATIONS)

8. UNDERSTANDING PWM USING PLC

9. UNDERSTANDING PID USING PLC

SCADA PRACTICALS:

1. USE OF SLIDER AS TAG AND DIFFERENT TAG GENERATION.

2. CREATING SIMPLE START STOP LOGIC USING A SCRIPT.

3. CREATING MIMIC FOR BOTTLE FILLING PLANT.

4. PASSWORD SETTING AND SECURITY IN SCADA.

5. USE OF REAL TIME AND HISTORICAL TREND FOR REAL TIME APPLICATION.

6. ACQUIRING PLC DATA THROUGH COMMUNICATION.

7. CONTROLLING PLC OUTPUT THROUGH SCADA TO RUN AC INDUCTION MOTOR.

8. CREATING AND UNDERSTANDING ALARMS.

Syllabus for B.Sc. (Honours) Electronics degree program under CBCS

SEMESTER I

ELECTRONICS DSC 1: NETWORK ANALYSIS AND ANALOG ELECTRONICS
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Circuit Analysis: **(14 Lectures)**
Concept of Voltage and Current Sources. Kirchhoff's Current Law, Kirchhoff's Voltage Law. Mesh Analysis. Node Analysis. Star and Delta networks, Star-Delta Conversion. Principal of Duality. Superposition Theorem. Thevenin's Theorem. Norton's Theorem. Reciprocity Theorem. Maximum Power Transfer Theorem. Two Port Networks: h, y and z parameters and their conversion

Junction Diode and its applications: **(18 Lectures)**
PN junction diode (Ideal and practical)-constructions, Formation of Depletion Layer, Diode Equation and I-V characteristics.Idea of static and dynamic resistance, dc load line analysis, Quiescent (Q) point. Zenerdiode, Reverse saturation current, Zener and avalanche breakdown. Qualitative idea ofSchottky diode. Rectifiers- Half wave rectifier, Full wave rectifiers (center tapped andbridge), circuit diagrams, working and waveforms, ripple factor and efficiency. Filter-Shunt capacitor filter, its role in power supply, output waveform, and working.Regulation- Line and load regulation, Zener diode as voltage regulator, and explanation for load and line regulation.

Bipolar Junction Transistor: . **(5 Lectures)**
Review of the characteristics of transistor in CE and CB configurations, Regions of operation (active, cut off and saturation), Current gains α and β. Relations between α and β. dc load line and Q point.

Amplifiers: **(10 Lectures)**
Transistor biasing and Stabilization circuits- Fixed Bias and Voltage Divider Bias. Thermal runaway, stability and stability factor S. Transistor as a two port network, h-parameter equivalent circuit. Small signal analysis of single stage CE amplifier. Input and Output impedance, Current and Voltage gains. Class A, B and C Amplifiers.

Cascaded Amplifiers: **(2 Lectures)**
Two stage RC Coupled Amplifier and its Frequency Response.

Feedback in Amplifiers: **(2 Lectures)**
Concept of feedback, negative and positive feedback, advantages of negative feedback (Qualitative only).

Sinusoidal Oscillators: **(5 Lectures)**
Barkhausen criterion for sustained oscillations. Phase shift and Colpitt's oscillator. Determination of Frequency and Condition of oscillation.

Unipolar Devices: **(4 Lectures)**
JFET. Construction, working and I-V characteristics (output and transfer), Pinchoff voltage. UJT, basic construction, working, equivalent circuit and I-V characteristics.

Reference Books:

1. Electric Circuits, S. A. Nasar, Schaum's outline series, Tata McGraw Hill (2004)
2. Electrical Circuits, M. Nahvi & J. Edminister, Schaum's Outline Series, Tata McGraw-Hill (2005)
3. Electrical Circuits, K.A. Smith and R.E. Alley, 2014, Cambridge University Press
4. Network, Lines and Fields, J.D.Ryder, Prentice Hall of India.
5. Electronic Devices and Circuits, David A. Bell, 5th Edition 2015, Oxford University Press.
6. Electronic Circuits: Discrete and Integrated, D.L. Schilling and C. Belove, Tata McGraw Hill
7. Electrical Circuit Analysis, Mahadevan and Chitra, PHI Learning
8. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford University Press.
9. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
10. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)

Laboratory experiments under DSC 1

At Least 15 Experiments From The Following

1. To familiarize with basic electronic components (R, C, L, diodes, transistors), digital Multimeter, Function Generator and Oscilloscope.
2. Measurement of Amplitude, Frequency & Phase difference using Oscilloscope.
3. Verification of (a) Thevenin's theorem and (b) Norton's theorem.
4. Verification of (a) Superposition Theorem and (b) Reciprocity Theorem.
5. Verification of the Maximum Power Transfer Theorem.
6. Study of the I-V Characteristics of (a) p-n junction Diode, and (b) Zener diode.
7. Study of (a) Half wave rectifier and (b) Full wave rectifier (FWR).
8. Study the effect of (a) C- filter and (b) Zener regulator on the output of FWR.
9. Study of the I-V Characteristics of UJT and design relaxation oscillator..
10. Study of the output and transfer I-V characteristics of common source JFET.
11. Study of Fixed Bias and Voltage divider bias configuration for CE transistor.
12. Design of a Single Stage CE amplifier of given gain.

13. Study of the RC Phase Shift Oscillator.
14. Study the Colpitt`s oscillator.
15. Construction of class A amplifier.
16. Construction of class B amplifier.
17. Construction of class C amplifier.
18. Study of Bridge rectifier.
19. Input and output characteristics of transistor in CE mode.
20. Use of diode as cliper.

Reference Books:

1. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata
2. McGraw-Hill (2005)
3. Networks, Lines and Fields, J.D.Ryder, Prentice Hall of India.
4. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
5. Allen Mottershead, Electronic Devices and Circuits, Goodyear Publishing Corporation.

ELECTRONICS DSC 2: MATHEMATICS FOUNDATION FOR ELECTRONICS

Unit-1 (16 Lectures)

Ordinary Differential Equations: First Order Ordinary Differential Equations, Basic Concepts, Separable Ordinary Differential Equations, Exact Ordinary Differential Equations, Linear Ordinary Differential Equations. Second Order homogeneous and non-homogeneous Differential Equations.

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

Unit-2 (14 Lectures)

Matrices: Introduction to Matrices, System of Linear Algebraic Equations, Gaussian Elimination Method, Gauss-Seidel Method, LU decomposition, Solution of Linear System by LU decomposition. Eigen Values and Eigen Vectors, Linear Transformation, Properties of Eigen Values and Eigen Vectors, Cayley-Hamilton Theorem, Diagonalization, Powers of a Matrix. Real and Complex Matrices, Symmetric, Skew Symmetric, Orthogonal Quadratic Form, Hermitian, Skew Hermitian, Unitary Matrices.

Unit-3 (14 Lectures)

Sequences and series: Sequences, Limit of a sequence, Convergence, Divergence and Oscillation of a sequence, Infinite series, Necessary condition for Convergence, Cauchy's Integral Test, D'Alembert's Ratio Test, Cauchy's nth Root Test, Alternating Series, Leibnitz's Theorem, Absolute Convergence and Conditional Convergence, Power Series.

Unit-4 (16 Lectures)

Complex Variables and Functions: Complex Variable, Complex Function, Continuity, Differentiability, Analyticity. Cauchy-Riemann (C- R) Equations, Harmonic and Conjugate Harmonic Functions, Exponential Function, Trigonometric Functions, Hyperbolic Functions. Line Integral in Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivative of Analytic Functions. Sequences, Series and Power Series, Taylor's Series, Laurent Series, Zeroes and Poles. Residue integration method, Residue integration of realIntegrals.

Reference Books

1. E. Kreyszig, advanced engineering mathematics, Wiley India (2008)
2. Murray Spiegel, Seymour Lipschutz, John Schiller, Outline of Complex Variables, Schaum Outline
Series, Tata McGraw Hill (2007)
3. R. K. Jain, and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House (2007)
4. C .R. Wylie and L. C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill (2004)
5. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Limited (2007)

Laboratory experiments under DSC 2

AT LEAST 15 experiements (usig MAtlab)

1. Solution of First Order Differential Equations.
2. Solution of Second Order homogeneous Differential Equations.
3. Solution of Second Order non-homogeneous Differential Equations
4. Convergence of a given series.
5. Divergence of a given series.
6. Solution of linear system of equations using Gauss Elimination method.
7. Solution of linear system of equations using Gauss – Seidel method.
8. Solution of linear system of equations using L-U decomposition method.
9. Implement Cauchy-Riemann (C- R) Equations.
10. Absolute Convergence.
11. Conditional Convergence.
12. Power Series implementation.
13. calculate Eigen Values of matrix.
14. Cayley-Hamilton Theorem.
15. Diagonalization.
16. finding the Powers of a Matrix.
17. Exponential Function Implemetation.
18. Trigonometric Functions Implemetation.
19. Hyperbolic Functions Implemetation.

Reference Books:

1. E. Kreyszig, advanced engineering mathematics, Wiley India (2008)
2. Murray Spiegel, Seymour Lipschutz, John Schiller, Outline of Complex Variables, Schaum Outline Series, Tata McGraw Hill (2007)
3. R. K. Jain, and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House (2007).

ELECTRONICS DSC 3: C PROGRAMMING
(Credits: Theory-04, Practicals-02)
Theory Lectures: 60 lectures

Unit- 1 (12 Lectures)

C Programming Language: Introduction, Importance of C, Character set, Tokens, keywords, identifier, constants, basic data types, variables, declaration & assigning values. Structure of C program.

Operators: 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 statements and library functions (math and string related functions).

Unit-2 (19 Lectures)

Decision making, branching & looping: Decision making, branching and looping: if, if-else, else-if, switch statement, break, for loop, while loop and do-while 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.

Unit-3 (20 Lectures)

Algorithm development using problem solving techniques: Computer Algorithm for iterative calculations, **Algorithms and methods:** Roots of a Quadratic polynomial, Solution of simultaneous linear equations, Bisection method, Regula falsi method, Newton Raphson method, Secant method, Simpson's 1/3 rd rule, Trapezoidal rule and Weddle's Rule.

Unit-4 (9 Lectures)

Searching and sorting: Insertion sort, selection sort, bubble sort, merge sort.

Trees : Introduction to trees, Binary search tree, Insertion and searching in a BST.

Reference Books:

1. Yeshvant Kanetkar, Let Us C , BPB Publications
2. Numerical methods for Engineers, Steven C. Chapra and Raymond P. Canale, 6th Edition, TMH.
3. Programming in ANSI C, Balagurusamy, 2nd edition, TMH.
4. Byron S Gottfried, Programming with C , Schaum Series
5. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, Prentice Hall
6. Yashavant Kanetkar, Pointers in C, BPB Publications
7. S. Sahni and E. Horowitz, "Data Structures", Galgotia Publications
8. Tanenbaum: "Data Structures using C", Pearson/PHI.

9. Ellis Horowitz and Sartaz Sahani “Fundamentals of Computer Algorithms”, Computer Science Press.

Laboratory experiments under DSC 3

AT LEAST 15 EXPERIMENTS FROM FOLLOWING.

1. Generate the Fibonacci series up to the given limit N and also print the number of elements in the series.
2. Find minimum and maximum of N numbers.
3. Find the GCD of two integer numbers.
4. Calculate factorial of a given number.
5. Find all the roots of a quadratic equation $Ax^2 + Bx + C = 0$ for non – zero coefficients A, B and C. Else report error.
6. Calculate the value of sin (x) and cos (x) using the series. Also print sin (x) and cos (x) value using library function.
7. Generate and print prime numbers up to an integer N.
8. Sort given N numbers in ascending order.
9. Find the sum & difference of two matrices of order MxN and PxQ.
10. Find the product of two matrices of order MxN and PxQ.
11. Find the transpose of given MxN matrix.
12. Calculate the subject wise and student wise totals and store them as a part of the structure.
13. Generate and print multiplication tables up to an integer, n.
14. Solution of simultaneous linear equations.
15. Implementation and solving using the Bisection method
16. Implementation and solving using the Regula falsi method
17. Implementation and solving using the Newton Raphson method
18. Implementation and solving using the Secant method
19. Implementation and solving using the Simpson’s 1/3 rd rule
20. Implementation and solving using the Trapezoidal rule
21. Implementation and solving using the Weddle’s Rule.
22. Implement Insertion sort, Merge sort, Bubble sort, Selection sort.

Reference Books:

1. Yeshvant Kanetkar, Let Us C , BPB Publications
2. Numerical methods for Engineers, Steven C. Chapra and Raymond P. Canale, 6th Edition, TMH.
3. Programming in ANSI C, Balagurusamy, 2nd edition, TMH.
4. Byron S Gottfried, Programming with C , Schaum Series
5. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, Prentice Hall

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SEMESTER II

ELECTRONICS DSC 4: LINEAR AND DIGITAL INTEGRATED CIRCUITS
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Operational Amplifiers (Black box approach): (**5 Lectures**)
Characteristics of an Ideal andPractical Operational Amplifier (IC 741), Open and closed loop configuration,Frequency Response. CMRR. Slew Rate and concept of Virtual Ground.
Applications of Op-Amps: (**12 Lectures**)
(1) Inverting and non-inverting amplifiers, (2) Summingand Difference Amplifier, (3) Differentiator, (4) Integrator, (5) Wein bridge oscillator,(6) Comparator and Zero-crossing detector, and (7) Active low pass and high pass Butterworth filter (1st order only).
Number System and Codes: (**9 Lectures**)
Decimal, Binary, Octal and Hexadecimal number systems, base conversions. Representation of signed and unsigned numbers, BCD code. Binary,octal and hexadecimal arithmetic; addition, subtraction by 2's complement method,multiplication.
Logic Gates and Boolean algebra: (**4 Lectures**)
Truth Tables of OR, AND, NOT, NOR, NAND,XOR, XNOR, Universal Gates, Basic postulates and fundamental theorems of Boolean algebra.
Combinational Logic Analysis and Design: (**5 Lectures**)
Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP).
Arithmetic Circuits: (**3 Lectures**)
Binary Addition. Half and Full Adder. Half and Full Subtractor, 4- bit binary Adder/Subtractor.
Data processing circuits: (**3 Lectures**)
Multiplexers, De-multiplexers, Decoders, Encoders.
Clock and Timer (IC 555): (**3 Lectures**)
Introduction, Block diagram of IC 555, Astable and Monostable multivibrator circuits.
Sequential Circuits: SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered)
Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop.
Master-slave JK Flip-Flop. (**6 Lectures**)
Shift registers: (2 **Lectures**)
Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).
Counters (4 bits): (**4 Lectures**)
Ring Counter. Asynchronous counters, Decade Counter.Synchronous Counter.
D-A and A-D Conversion: (**4 Lectures**)
4 bit binary weighted and R-2R D-A converters, circuit and working. Accuracy and Resolution. A-D conversion characteristics, successive approximation ADC. (Mention of relevant ICs for all).

Reference Books:

1.OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
2.Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, 2011, Oxford University Press.
3.Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011, Tata McGraw
4.Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
5.Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
6.Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning.
7.Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
8.R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)

Laboratory experiments under - DSC 3

At least 05 experiments each from section A, B and C

Section-A: Op-Amp. Circuits (Hardware)

1. To design an inverting amplifier using Op-amp (741,351)for dc voltage of given gain
2. (a) To design inverting amplifier using Op-amp (741,351) & study its frequency response
(b) To design non-inverting amplifier using Op-amp (741,351) & study frequency response
3. (a) To add two dc voltages using Op-amp in inverting and non-inverting mode
(b) To study the zero-crossing detector and comparator.
4. To design a precision Differential amplifier of given I/O specification using Op-amp.
5. To investigate the use of an op-amp as an Integrator.
6. To investigate the use of an op-amp as a Differentiator.
7. To design a Wien bridge oscillator for given frequency using an op-amp.
8. To design a circuit to simulate the solution of simultaneous equation and 1^{st} /2^{nd} order differential equation.
9. Design a Butterworth Low Pass active Filter (1st order) & study Frequency Response
10. Design a Butterworth High Pass active Filter (1st order) & study Frequency Response
11. Design a digital to analog converter (DAC) of given specifications.

Section-B: Digital circuits (Hardware)

1. (a) To design a combinational logic system for a specified Truth Table.
(b) To convert Boolean expression into logic circuit & design it using logic gate ICs.
(c) To minimize a given logic circuit.
2. Half Adder and Full Adder.
3. Half Subtractor and Full Subtractor.
4. 4 bit binary adder and adder-subtractor using Full adder IC.
5. To design a seven segment decoder.
6. To design an Astable Multivibrator of given specification using IC 555 Timer.
7. To design a Monostable Multivibrator of given specification using IC 555 Timer.
8. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
9. To build JK Master-slave flip-flop using Flip-Flop ICs
10. To build a Counter using D-type/JK Flip-Flop ICs and study timing diagram.
11. To make a Shift Register (serial-in and serial-out) using D-type/JK Flip-Flop ICs.

Section-C: SPICE/MULTISIM simulations for electronic circuits and devices

1. To verify the Thevenin and Norton Theorems.
2. Design and analyze the series and parallel LCR circuits
3. Design the inverting and non-inverting amplifier using an Op-Amp of given gain
4. Design and Verification of op-amp as integrator and differentiator
5. Design the 1storder active low pass and high pass filters of given cutoff frequency
6. Design a Wein`s Bridge oscillator of given frequency.
7. Design clocked SR and JK Flip-Flop`s using NAND Gates
8. Design 4-bit asynchronous counter using Flip-Flop ICs
9. Design the CE amplifier of a given gain and its frequency response.

Reference Books

1. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011,
2. Tata McGraw
3. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edn., 2000, Prentice Hall
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
5. Digital Electronics, S.K. Mandal, 2010, 1st edition, McGraw Hill

ELECTRONICS DSC 5: APPLIED PHYSICS
(Credits: Theory-04, Practicals-02)
Theory Lectures 60

Unit-1 **(19 Lectures)**

Quantum Physics: Inadequacies of Classical physics. Compton's effect, Photo-electric Effect, Wave-particle duality, de Broglie waves. Basic postulates and formalism of quantum mechanics: probabilistic interpretation of waves, conditions for physical acceptability of wave functions. Schrodinger wave equation for a free particle and in a force field (1 dimension), Boundary and continuity conditions. Operators in Quantum Mechanics, Conservation of probability, Time-dependent form, Linearity and superposition, Operators, Time independent one dimensional Schrodinger wave equation, Stationary states, Eigen-values and Eigen functions.

Particle in a one-dimensional box, Extension to a three dimensional box, Potential barrier problems, phenomenon of tunneling. Kronig Penney Model and development of band structure. Spherically symmetric potentials, the Hydrogen-like atom problem.

Unit-2 **(11 Lectures)**

Mechanical Properties of Materials: Elastic and Plastic Deformations, Hooke's Law, Elastic Moduli, Brittle and Ductile Materials, Tensile Strength, Theoretical and Critical Shear Stress of Crystals. Strengthening Mechanisms, Hardness, Creep, Fatigue, Fracture.

Unit-3 **(15 Lectures)**

Thermal Properties: Brief Introduction to Laws of Thermodynamics, Concept of Entropy, Concept of Phonons, Heat Capacity, Debye's Law, Lattice Specific Heat, Electronic Specific Heat, Specific Heat Capacity for Si and GaAs, Thermal Conductivity, Thermoelectricity, Seebeck Effect, Thomson Effect, Peltier Effect.

Unit-4 **(15 Lectures)**

Electric and Magnetic Properties: Conductivity of metals, Ohm's Law, relaxation time, collision time and mean free path, electron scattering and resistivity of metals, heat developed in current carrying conductor, Superconductivity. Classification of Magnetic Materials, Origin of Magnetic moment, Origin of dia, para, ferro and antiferro magnetism and their comparison, Ferrimagnetic materials, Saturation Magnetisation and Curie temperature, Magnetic domains, Concepts of Giant Magnetic Resistance (GMR), Magnetic recording.

Reference Books:

1. S. Vijaya and G. Rangarajan, Material Science, Tata Mcgraw Hill (2003)
2. W. E. Callister, Material Science and Engineering: An Introduction, Wiley India (2006)
3. A. Beiser, Concepts of Modern Physics , McGraw-Hill Book Company (1987)
4. A. Ghatak & S. Lokanathan, Quantum Mechanics: Theory and Applications, Macmillan India (2004)

Laboratory experiments under -DSC 5

AT LEAST 15 EXPERIMENTS FROM FOLLOWING.

1. To determine Young's modulus of a wire by optical lever method.
2. To determine the modulus of rigidity of a wire by Maxwell's needle.
3. To determine the modulus of rigidity of a wire by Torsional Oscillation.
4. To determine the modulus of rigidity of a material of a beam used as cantilever.
5. To determine the elastic constants of a wire by Searle's method.
6. To determine the spring constant using Hookes Law
7. To determine the value of Boltzmann Constant by studying forward characteristics of diode.
8. To determine of Planck's Constant using Photo Vacuum Tube.
9. To determine of Planck's Constant using Light Emitting Diode (LED).
10. Verification of Stefan's law by electrical method.
11. To determine e/m of electron by Bar Magnet or by Magnetic Focusing.
12. Study of Faraday's Law of Electromagnetic Induction
13. Determination of the specific resistance of the Constantan wire using the Carey Foster's Bridge.
14. Study of the Seebeck Effect
15. Study of the Peltier Effect.
16. Determining the value of specific charge e/m of an electron by Thomson Method.
17. To determine the resistance of several wires by applying Ohm's Law.
18. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
19. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
20. To study the variation of thermo emf across two junctions of a thermocouple with temperature.

ELECTRONICS DSC 6: PHOTONICS
(Credits: Theory-04, Practicals-02)
Theory Lectures 60

Unit-1 (22 Lectures)
Light as an Electromagnetic Wave: Plane waves in homogeneous media, concept of spherical waves. Reflection and transmission at an interface, total internal reflection, Brewster's Law. Interaction of electromagnetic waves with dielectrics: origin of refractive index, dispersion.
Interference : Superposition of waves of same frequency, Concept of coherence, Interference by division of wavefront, Young's double slit, Division of Amplitude, thin film interference, anti-reflecting films, Newton's rings; Michelson interferometer. Holography.
Diffraction: Huygen Fresnel Principle, Diffraction Integral, Fresnel and Fraunhoffer approximations. Fraunhoffer Diffraction by a single slit, rectangular aperture, double slit, Resolving power of microscopes and telescopes; Diffraction grating: Resolving power and Dispersive power

Unit-2 (13 Lectures)
Polarization: Linear, circular and elliptical polarization, polarizer-analyzer and Malus' law; Double refraction by crystals, Interference of polarized light, Wave propagation in uniaxial media. Half wave and quarter wave plates. Faraday rotation and electro-optic effect.

Unit-3 (13 Lectures)
Light Emitting Diodes: Construction, materials and operation.
Lasers: Interaction of radiation and matter, Einstein coefficients, Condition for amplification, laser cavity, threshold for laser oscillation, line shape function. Examples of common lasers. The semiconductor injection laser diode.
Photodetectors: Bolometer, Photomultiplier tube, Charge Coupled Device. Photo transistors and Photodiodes (p-i-n, avalanche), quantum efficiency and responsivity.
LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays, applications, advantages over LED displays.

Unit-4 (12 Lectures)
Guided Waves and the Optical Fiber: TE and TM modes in symmetric slab waveguides, effective index, field distributions, Dispersion relation and Group Velocity. Step index optical fiber, total internal reflection, concept of linearly polarized waves in the step index circular dielectric waveguides, single mode and multimode fibers, attenuation and dispersion in optical fiber.

Reference Books:
1. Ajoy Ghatak, Optics, Tata McGraw Hill, New Delhi (2005)
2. E. Hecht, Optics, Pearson Education Ltd. (2002)
3. J. Wilson and J. F. B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India

(1996)
4. S. O. Kasap, Optoelectronics and Photonics: Principles and Practices, Pearson Education (2009)
5. Ghatak A.K. and Thyagarajan K., “Introduction to fiber optics,” Cambridge Univ. Press. (1998)

Laboratory experiments under: DSC 6

At least 15 experiments from following list

1. To verify the law of Malus for plane polarized light.
2. To determine wavelength of sodium light using Michelson’s Interferometer.
3. To determine wavelength of sodium light using Newton’s Rings.
4. To determine the resolving power and Dispersive power of Diffraction Grating.
5. Diffraction experiments using a laser.
6. Study of Faraday rotation.
7. Study of Electro-optic Effect.
8. To determine the specific rotation of scan sugar using polarimeter.
9. To determine characteristics of LEDs (Radiation pattern, Power Vs. Current)
10. To measure the numerical aperture of an optical fiber.
11. Design of Photo detector circuit using OP-amp
12. Design of digital optical receiver using comparator
13. To determine characteristics Photo- detector (rise time, radiation pattern, Power Vs. Current)
14. Light coupling in optical fiber, Numerical aperture of Fiber
15. Construction of Analog optical transmitter
16. Construction of Digital optical transmitter
17. Coupling efficiency in SMF and MMF fibers
18. Misalignment losses on fibers
19. Design of analog optical audio receiver
20. Comparioson of Laser diode with LEDs

Reference Books:

1. J. Wilson and J. F. B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India
2. (1996)
3. S. O. Kasap, Optoelectronics and Photonics: Principles and Practices, Pearson
4. Education (2009)
5. Ghatak A.K. and Thyagarajan K., “Introduction to fiber optics,” Cambridge Univ.
6. Press. (1998)

Syllabus DSC7- DSC14 will provided in due course of time

Syllabus DSE1- DSE4 will provided in due course of time

SKILL ENHANCEMENT COURSES (SEC)

SEC 1: DESIGN AND FABRICATION OF PCB

(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

PCB Fundamentals: 15
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: 20
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: 20
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: 5
Trends, Environmental concerns in PCB industry.

Reference Books:

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

Laboratory experiments under SEC 1 :
AT LEAST 15 EXPERIMENTS FROM FOLLOWING.

1. Designing of PCB using artwork, its fabrication and testing.
2. Design, fabrication and testing of a 9 V power supply with zener regulator
3. Etching & drilling of PCB.
4. Wiring & fitting shop:
5. Introduction to soldering practice

6. Fitting of power supply along with a meter in cabinet.
7. Testing of regulated power supply fabricated.
8. PCB Design of Astable multivibrator
9. Introduction to PCB Design software
10. Generation of CAM Files for single side PCB (Measuring voltage Drop)
11. Generation of CAM Files for single side PCB (Full wave Rectifier)
12. Generation of CAM Files for single side PCB (Half wave Rectifier)
13. Generation of CAM Files for single side PCB(Tarsistorised amplifier)
14. PCB Assembly and Testing (Half wave Rectifier)
15. PCB Assembly and Testing (Measuring voltage Drop)
16. PCB Assembly and Testing (Full wave Rectifier)
17. Study of single side PCB Fabrication process by photo resit

Reference Books:

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

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SEC 2: PROGRAMMING WITH SCILAB/MATLAB

(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Unit I- Introduction to Programming: (8L)
Components of a computer, working with numbers, Machine code, Software hierarchy.
Unit II- Programming Environment: (10L)
SCILAB Environment, Workspace, Working Directory,Expressions, Constants, Variables and assignment statement, Arrays.
Unit III- Graph Plots: (8L)
Basic plotting, Built in functions, Generating waveforms, Sound replay, load and save.
Unit IV- (8L)
Matrices and Some Simple Matrix Operations, Sub- Matrices.
Unit IV- (8L)
Procedures and Functions: Arguments and return values,
Unit V-Control Statements: (10L)
Conditional statements: If, Else, Else-if, Repetition statements:While, for loop.
Unit VI- Manipulating Text: (8L)
Writing to a text file, Reading from a text file, Randomising and sorting a list, searching a list.
Reference Books:

1. M.Affouf, SCILAB by Example , CreateSpace Independent Publishing Platform,2012

2. H. Ramchandran, A.S. Nair, SCILAB , S.Chand, 2011

Laboratory experiments under SEC 2:

AT LEAST 15 EXPERIMENTS FROM FOLLOWING.

1. Write a program to assign the following expressions to a variable A and then to print out the value of A.
a. (3+4)/(5+6)
b. 2pi square
c.sqare root of 2
d. $(0.0000123 + 5.67\times10^{-3}) \times 0.4567\times10^{-4}$
2. Celsius temperatures can be converted to Fahrenheit by multiplying by 9, dividing by 5, and adding 32. Assign a variable called C the value 37, and implement this formula to assign a variable F the Fahrenheit equivalent of 37 Celsius.
3. Set up a vector called N with five elements having the values: 1, 2, 3, 4, 5. Using N, create assignment statements for a vector X which will result in X having these values:
a. 2, 4, 6, 8, 10
b. 1/2, 1, 3/2, 2, 5/2
c. 1, 1/2, 1/3, 1/4, 1/5
d. 1, 1/4, 1/9, 1/16, 1/25
4. A supermarket conveyor belt holds an array of groceries. The price of each product (in pounds) is [0.6, 1.2 ,0.5, 1.3] ; while the numbers of each product are [3, 2 ,1 ,5]. Use MATLAB to calculate the total bill.
5. The sortrows(x) function will sort a vector or matrix X into increasing row order. Use this function to sort a list of names into alphabetical order.
6. The “identity” matrix is a square matrix that has ones on the diagonal and zeros elsewhere. You can generate one with the eye() function in MATLAB. Use MATLAB to find a matrix B, such that when multiplied by matrix A=[1 2; -1 0] the identity matrix I=[1 0; 0 1] is generated. That is A*B=I.
7. Create an array of N numbers. Now find a single MATLAB statement that picks out from that array the 1,4,9,16,…,√Nth entries, i.e. those numbers which have indices that are square numbers.
8. Draw a graph that joins the points (0,1), (4,3), (2,0) and (5,-2).
9. The seeds on a sunflower are distributed according to the formula below. Plot a small circle at each of the first 1000 co-ordinates :
10. Calculate 10 approximate points from the function y=2x by using the formulae:
i. xn = n
ii. yn = 2n + rand - 0.5
Fit a line of best fit to these points using the function polyfit() with degree=1, and generate co-ordinates from the line of best fit using polyval(). Use the on-line help to find out how to use these functions. Plot the raw data and the line of best fit.
11. Calculate and replay 1 second of a sinewave at 500Hz with a sampling rate of 11025Hz. Save the sound to a file called "ex35.wav". Plot the first 100 samples.

12. Calculate and replay a 2 second chirp. That is, a sinusoid that steadily increases in frequency with time, from say 250Hz at the start to 1000Hz at the end.
13. Build a square wave by adding together 10 odd harmonics: 1f, 3f, 5f, etc. The amplitude of the nth harmonic should be 1/n. Display a graph of one cycle of the result superimposed on the individual harmonics.
14. Write a function called FtoC (ftoc.m) to convert Fahrenheit temperatures into Celsius. Make sure the program has a title comment and a help page. Test from the command window with:
i. FtoC(96)
ii. lookfor Fahrenheit
iii. help FtoC
15. Write a program to input 2 strings from the user and to print out (i) the concatenation of the
two strings with a space between them, (ii) a line of asterisks the same length as the concatenated strings, and (iii) the reversed concatenation. For example:
i. Enter string 1: Mark
ii. Enter string 2: Huckvale
iii. Mark Huckvale
iv. **********
v. elavkcuH kraM

Reference Books:

1. M.Affouf, SCILAB by Example , CreateSpace Independent Publishing Platform,2012

2. H. Ramchandran, A.S. Nair, SCILAB , S.Chand, 2011

SEC 3: PROGRAMMING WITH PYTHON
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation. **4L**

Techniques of Problem Solving: Flowcharting, decision table, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming. **6L**

Overview of Programming : Structure of a Python Program, Elements of Python **4L**

Introduction to Python: Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings, Operators(Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator) **6L**

Creating Python Programs: Input and Output Statements, Control statements(Branching, Looping, Conditional Statement, Exit function, Difference **8L**

between break, continue and pass.), Defining Functions, default arguments, Errors and Exceptions.

Iteration and Recursion: 8L

Conditional execution, Alternative execution, Nested

conditionals, The return statement, Recursion, Stack diagrams for recursive functions, Multiple assignment, The while statement, Tables, Two-dimensional tables Strings and Lists: String as a compound data type, Length, Traversal and the for 8L
loop, String slices, String comparison, A find function, Looping and counting, List values, Accessing elements, List length, List membership, Lists and for loops, List operations, List deletion. Cloning lists, Nested lists
Object Oriented Programming: Introduction to Classes, Objects and Methods, 4L
Standard Libraries.
Data Structures: Arrays, list, set, stacks and queues. 4L
Searching and Sorting: Linear and Binary Search, Bubble, Selection and Insertion 6L
sorting.

References :

1. T. Budd, Exploring Python, TMH, 1st Ed, 2011

2. How to think like a computer scientist : learning with Python / Allen Downey, Jeffrey Elkner, Chris Meyers. 1st Edition – Freely available online.2012
1. http://docs.python.org/3/tutorial/index.html
2. http://interactivepython.org/courselib/static/pythonds

Laboratory experiments under SEC 3

Atleast 15 experiments from the below list

1. Using for loop, print a table of Celsius/Fahrenheit equivalences. Let c be the Celsius temperatures ranging from 0 to 100, for each value of c, print the corresponding Fahrenheit temperature.

2. Using while loop, produce a table of sins, cosines and tangents. Make a variable x in range from 0 to 10 in steps of 0.2. For each value of x, print the value of sin(x), cos(x) and tan(x).

3. Write a program that reads an integer value and prints —leap year or —not a leap year .

4. Write a program that takes a positive integer n and then produces n lines of output shown as follows.

For example enter a size: 5

*
**
***
****
*****

5. Write a function that takes an integer _n' as input and calculates the value of 1 + 1/1! + 1/2! + 1/3! + … + 1/n
6. Write a function that takes an integer input and calculates the factorial of that number.

7. Write a function that takes a string input and checks if it's a palindrome or not.

8. Write a list function to convert a string into a list, as in list (_abc') gives [a, b, c].

9. Write a program to generate Fibonacci series.

10. Write a program to check whether the input number is even or odd.

11. Write a program to compare three numbers and print the largest one.
12. Write a program to print factors of a given number.

13. Write a method to calculate GCD of two numbers.

14. Write a program to create Stack Class and implement all its methods. (Use Lists).

15. Write a program to create Queue Class and implement all its methods. (Use Lists)

16. Write a program to implement linear and binary search on lists.

17. Write a program to sort a list using insertion sort and bubble sort and selection sort.

References :

1. T. Budd, Exploring Python, TMH, 1st Ed, 2011
2. How to think like a computer scientist : learning with Python / Allen Downey, Jeffrey

SEC 4: SMART PHONE APPS DEVELOPMENT

Will be provided later

GENERAL ELECTIVE PAPERS

GE 1: ELECTRONICS CIRCUITS AND PCB DESIGNING

(Credits: Theory-04)
Theory: 60 Lectures

Unit-1 (12 Lectures)
Network theorems (DC analysis only): Review of Ohms law, Kirchhoff's laws, voltage divider and current divider theorems, open and short circuits.
Thevenin's theorem, Norton's theorem and interconversion, superposition theorem, maximum power transfer theorem.

Unit 2 (13 Lectures)
Semiconductor Diode and its applications: PN junction diode and characteristics, ideal diode and diode approximations. Block diagram of a Regulated Power Supply, Rectifiers: HWR, FWR- center tapped and bridge FWRs. Circuit diagrams, working and waveforms, ripple factor & efficiency(no derivations).Filters: 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-3 (17 Lectures)
BJT and Small Signal amplifier: Bipolar Junction Transistor: Construction, principle & working of NPN transistor, terminology. Configuration: CE, CB, CC. Definition of α, β and γ and their interrelations, leakage currents. Study of CE Characteristics, Hybrid parameters. Transistor biasing: need for biasing, DC load line, operating point, thermal runaway, stability and stability factor.
Voltage divider bias: circuit diagrams and their working, Q point expressions for voltage divider biasing.
Small signal CE amplifier: circuit, working, frequency response, re model for CE configuration, derivation for Av, Zin and Zout.

Unit-4 (18 Lectures)
Types of PCB: Single sided board, double sided, Multilayer boards, Plated through holes technology, Benefits of Surface Mount Technology (SMT), Limitation of SMT, Surface mount components: Resistors, Capacitor, Inductor, Diode and IC's.
Layout and Artwork: Layout Planning: General rules of Layout, Resistance, Capacitance and Inductance, Conductor Spacing, Supply and Ground Conductors, Component Placing and mounting, Cooling requirement and package density, Layout check.
Basic artwork approaches, Artwork taping guidelines, General artwork rules: Artwork check and Inspection.
Laminates and Photoprinting: Properties of laminates, Types of Laminates, Manual

cleaning process, Basic printing process for double sided PCB's, Photo resists, wet film resists, Coating process for wet film resists, Exposure and further process for wet film resists, Dry film resists

Etching and Soldering: Introduction, Etching machine, Etchant system. Principles of Solder connection, Solder joints, Solder alloys, Soldering fluxes. Soldering, Desoldering tools and Techniques.

Reference Books:

1. Electronic Devices and circuit theory, Robert Boylstead and Louis Nashelsky, 9th Edition, 2013, PHI
2. Electronics text lab manual, Paul B. Zbar.
3. Electric circuits, Joeseph Edminister, Schaum series.
4. Basic Electronics and Linear circuits, N.N. Bhargava, D.C. Kulshresta and D.C Gupta -TMH.
5. Electronic devices, David A Bell, Reston Publishing Company/DB Tarapurwala Publ.
6. Walter C.Bosshart "PCB DESIGN AND TECHNOLOGY" Tata McGraw Hill Publications, Delhi. 1983
7. Clyde F.Coombs "Printed circuits Handbook" III Edition, McGraw Hill.

GE 2:BASICS OF ROBOTICS

(Credits: Theory-04)
Theory: 60 Lectures

Programming Environments: 15
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: 10
DC Motors, Gearing and Efficiency, Servo Motors, Stepper motors, Motor Control and its implementations.

Sensors: 10
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 3
with the robot (2 x 16 Characters LCD)

Other indicators: **3**
Indicator LEDs, Buzzer

Timer / Counter operations: 12
PWM generation, Motor velocity control, Servo control, velocity calculation and motor position Control, event scheduling.

Communication 8
Wired RS232 (serial) Communication, Wireless ZigBee Communication, USB Communication, Simplex infrared Communication (IR remote to robot).

Reference 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.

GE 3: SMART PHONE APPS DEVELOPMENT

(Credits: 04) 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: 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

GE 4: CCTV INSTALLATION AND NETWORKING
(Credits: 04) Total Lectures 60

Introduction to SI units of measurement, Light and television 3
The basic units, Derived units , Metric prefixes , A little bit of history, Light basics and the human eye , Light units, Measuring object illumination in CCTV , Light onto an imaging device , Colors in television , Color temperatures and light sources , Eye persistence

Optics in CCTV 6
Refraction, Lenses as optical elements ,Geometrical construction of images, Aspherical lenses, CTF and MTF, F and T numbers ,Depth of field, Neutral density (ND) filters,
Manual, auto, and motorized iris lenses , Video- and DC-driven auto iris lenses, Auto Iris lens electronics ,Image and lens formats in CCTV, Angles of view and how to determine them ,Fixed focal length lenses, Zoom lenses ,C- and CS-mount and back-focus,Back-focus adjustment ,Optical accessories in CCTV.

General characteristics of television systems 2
A little bit of history, the very basics of television, the video signal and its spectrum, Color video signal, Resolution, Instruments commonly used in TV, Oscilloscope, Spectrum analyzer, Vectorscope, Television systems around the world, HDTV

CCTV cameras 6
General information about cameras , Tube cameras, CCD cameras, Sensitivity and resolution of the CCD chips, Types of charge transfer in CCDs, Pulses used in CCD for transferring charges, CCD chip as a sampler, Correlated double sampling (CDS),
Camera specifications and their meanings, Sensitivity, Minimum illumination, Camera resolution, Signal/noise ratio (S/N), Dynamic range of a CCD chip, Color CCD cameras,
White balance, CMOS technology, Special low-light intensified cameras, Camera power supplies and copper conductors, V-phase adjustment , Camera checklist.

CCTV monitors 2
General about monitors, Monitor sizes, Monitor adjustments, Impedance switch, Viewing conditions, Gamma, LCD monitors, Projectors and projection monitors, Plasma display monitors, Field emission technology displays.

Video processing equipment 2
Analog switching equipment , Video sequential switchers, Synchronization, Video matrix switchers (VMSs), Switching and processing equipment , Quad compressors, Multiplexers (MUX), Recording time delays, Simplex and duplex multiplexers, Video motion detectors (VMDs), Framestores, Video printers.

Analog video recorders **2**

A little bit of history and the basic concept, The early VCR concepts, The video home system (VHS) concept , Super VHS, Y/C, and comb filtering, Consumer VCRs for CCTV purposes , Time-lapse VCRs (TL VCRs).

Digital video **5**

Why digital video?, Digital video recorders (DVRs), The various standards, ITU-601: Merging the NTSC and PAL, The resolution of ITU-601 digitized video, The need for compression, Types of compressions , DCT as a basis, the variety of compression standards in CCTV,JPEG,M-JPEG, M-JPEG, Wavelet, Motion JPEG 2000, MPEG-1,MPEG-2,

MPEG-4, MPEG-7, MPEG-21, H.320, H.261, H.263, H.264, About pixels and resolution

Dots per inch (DPI), Psychophysiology of viewing details, Recognizing faces and license plates in CCTV, Operating systems and hard disks, Hard disk drives, The different file systems, FAT (File Allocation Table), FAT 32 (File Allocation Table 32),NTFS (New Technology File System), Ext2 ,Ext3,ReiserFS, HFS and HFS+ , XFS , UFS, ATA, SCSI, RAID, and SATA , MTBF (Mean Time Between Failure)

Transmission media **4**

Coaxial cables ,The concept ,Noise and electromagnetic interference, Characteristic impedance , BNC connectors, Coaxial cables and proper BNC termination, Installation techniques, Time domain reflectometer (TDR) , Twisted pair video transmission, Microwave links, RF wireless (open air) video transmission ,Infrared wireless (open air) video transmission,

Transmission of images over telephone lines, PSTN, ISDN, Cellular network, Fiber optics,

Why fiber?, The concept, Types of optical fibers, Numerical aperture, Light levels in fiber optics, Light sources in fiber optics transmission, Light detectors in fiber optics ,Frequencies in fiber optics transmission, Passive components, Fusion splicing , Mechanical splicing, Fiber optics multiplexers, Fiber optics cables, Installation techniques, Fiber optic link analysis, OTDR

Networking in CCTV **7**

The Information Technology era, Computers and networks, LAN and WAN, Ethernet,

The main Ethernet categories, 10 Mb/s Ethernet (IEEE 802.3), Fast Ethernet (IEEE 802.3U),

Gigabit Ethernet (IEEE 802.3Z), Gigabit Ethernet over Copper (IEEE 802.3AB), 10 Gigabit Ethernet, Wireless Ethernet (IEEE 802.11), Data speed and types of network cabling, Patch and crossover cables, Fiber optics network cabling , Network concepts and components,

Networking software, The Internet protocols , The OSI seven-layer model of networking,

The Physical layer ,The Data Link layer,The Network layer,The Transport layer,The Session layer,The Presentation layer,The Application layer,IP addresses ,IPv4 addressing notation,IP address classes,Class A, B, and C ,Private addresses , IP address Class C, IP loopback address,

Zero addresses, IP address Class D and Multicast, IP address Class E and limited broadcast, IP network partitioning, Virtual private networking (VPN), Subnetting, IPv6 Address Types, Reserved addresses in IPv6, Domain Name Systems (DNS), DHCP, DNS and DHCP , Networking hardware, Hubs, bridges, and switches, Routers for logical segmentation, Network ports, A network analogy example, Wireless LAN, 802.11, 802.11 (legacy), 802.11b, 802.11a,

802.11g , 802.11n, Certification and security, Bluetooth, Putting a network system together The IP check commands

Auxiliary equipment in CCTV **2**

Pan and tilt heads , Pan and tilt domes, Preset positioning P/T heads, PTZ site drivers, Camera housings, Lighting in CCTV, Infrared lights, Ground loop correctors, Lightning protection, In-line video amplifiers/equalizers, Video distribution amplifiers (VDAs)

CCTV system design **2**

Understanding the customer's requirements , Designing and quoting a CCTV system Installation considerations, Drawings, Commissioning , Training and manuals, Handing over , Preventative maintenance.

Video testing **2**

The CCTV Labs test chart , Before you start testing , Use high-quality lens, Use high-quality monitor, Setup procedure , What you can test, Resolution, Other important measurements, Getting the best possible picture, Measurement of the digital image compression quality, The CCTV Labs test pattern generator TPG-8, How you could use the TPG-8, TPG-8 buttons description, Connections, The TPG-8 Navigator software, Instruments used with the TPG-8, Test patterns and how to create them, Specifications

REFERENCE BOOK:

1. CCTV Networking and Digital Technology 2nd Edition Vlado Damjanovski(Elsevier Butterworth–Heinemann)
2. CCTV surveillance by Herman Kruegle.
3. Digital Video Surveillance and Security, Second Edition by Anthony C. Caputo

GE 5:REPAIR AND MAINTENANCE OF ELECTRICAL AND ELECTRONIC APPLIANCES
(Credits: 04) Total Lectures 60

UNIT I **10**
HEATING APPLIANCES:

1. Electrical iron – introduction working principle and construction, operation, operation of ordinary and automatic iron.
2. Electric stove- Introduction, working principle and construction, operation of coil type and hot plate.
3. Electric cooking range and grill /oven; Introduction, working principle and construction operation.
4. Electric toaster - Introduction, working principle and construction operation of ordinary and automatic.
5. Immersion heater: Introduction, working principle and construction.
6. Electric geyser: Introduction, working principle and construction and installation of pressure and non-pressure type.
7. Electric kettle: Introduction, working principle and construction of swan neck type and cylindrical type.
8. Microwave oven: Introduction, working principle and construction operation.
9. Induction Cook top: Introduction, working principle and construction operation.

UNIT II **10**
MOTORIZED APPLIANCES:

1. Electric room heater: Introduction, working principle and construction of blower type room heater.
2. Electric fan: introduction, working principle construction speed control method and different accessories. (Ceiling Fan and Table Fan)
3. Electric Mixer grinder, juicer: Introduction, working principle and construction, speed control method and different accessories.
4. Electric washing machine and dryer: Introduction, working principle and construction of semi automatic agitator type, panel; controls and brief introduction of other type.
5. Hair dryer: Introduction, working principle and construction speed control method.
6. Vacuum cleaner: Introduction, working principle and construction of upright type and tank type.
7. Electric hand drills: Introduction, working principle and construction.

UNIT III **10**

Electrical and electronic appliances

1. Electric gas lighter: Introduction, Working Principal, Construction.
2. Electric bell and buzzer: Introduction, Working Principal, Construction.
3. Emergency light: Introduction, Working Principal, Construction, with block diagram, bulb and florescent lamp types.
4. Voltage Stabilizers: Introduction, Working Principal, Construction with block diagram of servo type and relay type.
5. Power Supply, Linear Regulated Power Supply and Switch mode Power Supply, Block diagram and Working Principle.
6. Uninterrupted Power Supply (UPS), Block Diagram and Working Principle.
7. Battery Charger: Introduction, Working Principal, Construction.
8. Solar Voltaic cell: Working, types, modules, panels, arrays and applications
9. Inverter
10. Tube light: different parts of Working, connection

UNIT IV **10**

Visual electronic appliances

Introduction, Study of block diagram, working principal and different sections of

1. Public address system:
2. AM/FM transistor receiver
3. CD/DVD player
4. LCD/LED Television

Introduction and installation of DTH.

UNIT V **5**

Energy Consumption and Preventive Maintenance

General Precautions, handling and maintenance for all types of electrical and electronic domestic.

Appliances, Energy consumption.

1. Energy meter: Introduction, working, Connection and Energy meter reading:
2. Power Calculation of Load
3. Electricity Bill calculation

Reference Books

1. The Repair & Maintenance Of Electrical Equipment: A Complete Guide To Troubleshooting Portableelectric Tools And Generators. Front Cover. Fred Sotcher.

2. Troubleshooting Electronic Equipment: Includes Repair And Maintenance,R.S.Khandpur , Second Edition.