Syllabus (CBCS)

Bachelor of Science (HONOURS)

Core Papers

Sr. No	Semester	Course Code	Subject Title	Credits (T+P)
1.	I	DSC 1A ELC 101	Network Analysis and Analog Electronics	4+2
2.	II	DSC 1B ELC 102	Linear and Digital Integrated Circuits	4+2
3.	III	DSC 1C ELC 103	Communication Electronics	4+2
4.	IV	DSC 1D ELC 104	Microprocessor and Microcontrollers	4+2
5.	V	DSC 5 ELC 105	Operating system	4+2
6.		DSC 6 ELC 115	Power Electronics	4+2
7.		DSC 7 ELC 125	Transducers and Instrumentation	4+2
8.	VI	DSC 8 ELC 106	Computer Networks and Administration	4+2
9.		DSC 9 ELC 116	Biomedical and Pharmaceutical Instrumentation	4+2
10.		DSC 10 ELC 126	Embedded Systems	4+2

Discipline specific courses (DSE)

Sr. No	Semester	Course Code	Subject Title	Credits (T+P)
1	**V(DSE 1 & DSE 2)** *(Any 2 subject titles has to be offered)*	ELD 105	Photonics	3+1
		ELD115	Programming with MATLAB	3+1
		ELD125	Programming with Scilab	3+1
2	**VI (DSC 3)** *(Any one subject title has to be offered)*	ELD 106	Industrial Automation	3+1
		ELD 116	SWAYAM	Any available which makes 3+1* credit
		ELD126	VERILOG	3+1
		ELD136	FPGA Based System Design	3+1
		ELD146	Programming With Python	3+1
3	**VI**	ELP 106	Electronics Project	4

- One credit practical's may be designed by instructor monitoring course

Skill Enhancement Courses

Sr. No.		Course Code	Subject Title	Credits (T+P)
1	III	SEC 1 ELS 103	**Programming in C++ (Flipped Classroom)**	3+1
2	IV	SEC 2 ELS 104	Smart Phone Apps Development **(Flipped Classroom)**	3+1

General Elective papers

Sr. No.		Course Code	Subject Title	Credits (T)
1.	I	ELG 101	Electronics circuits and PCB designing/ consumer Electronics	3+1
2.	II	ELG 102/ELG112	Repair and Maintenance of Electrical and Electronic Appliances/ Medical Home Instruments	3+1 3+1

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: **(14Lectures)**
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. Zener diode, Reverse saturation current, Zener and avalanche breakdown. Qualitative idea of Schottky diode. Rectifiers- Half wave rectifier, Full wave rectifiers (centre tapped and bridge), 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 andβ. 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), Pinch off voltage. UJT, basic construction, working, equivalent circuit and I-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 clipper.

Reference Books:

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

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: (**6 Lectures**)
SR, D, & 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.

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 1st/2ndorder 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's 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 1st order active low pass and high pass filters of given cut-off 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,Tata McGraw
2. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edn., 2000, Prentice Hall
3. Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
4. Digital Electronics, S.K. Mandal, 2010, 1st edition, McGraw Hill

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

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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, 5thEdition 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 ANDMICROCONTROLLER
(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 microcontrollers, 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 microcontrollers, 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. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.
4. Microprocessor and Microcontrollers, N. Senthil Kumar, 2010, Oxford University Press
5. 8051 microcontrollers, Satish Shah, 2010, Oxford University Press.
6. Embedded Systems: Design & applications, S.F. Barrett, 2008, Pearson Education India
7. Introduction to embedded system, K.V. Shibu, 1st edition, 2009, McGraw Hill

8. Embedded Microcomputer systems: Real time interfacing, J.W. Valvano 2011, Cengage Learning
9. 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 microcontrollers:

1. To find that the given numbers are 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, TMH
3. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.
4. 8051 microcontrollers, Satish Shah, 2010, Oxford University Press.
5. Embedded Microcomputer systems: Real time interfacing, J.W.Valvano 2011,Cengage Learning

Semester V

ELECTRONICS-DSC5: OPERATING SYSTEM

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

Operating Systems Overview: **(9L)**
Operating System Objectives and Functions, Evolution of operating systems, major Achievements, characteristics of Modern Operating Systems, Introduction to Embedded & RTOS.

Processes: **Process Description and Control:** **(9L)**
Process states, Process description, Process control.
Threads, SMP and Microkernels:
Processes and Threads, Symmetric Multiprocessing, Microkernels.

Concurrency: Mutual Exclusion and Synchronization: (**13L)**
Principles of Concurrency, Mutual Exclusion: Software approaches, Mutual Exclusion: Hardware support, Semaphores, message passing. Concurrency: Deadlock and Starvation: Principles of Deadlock, Deadlock Prevention, Deadlock avoidance, Deadlock detection, An integrated deadlock strategy, dining philosopher's problem

Scheduling: Uniprocessor Scheduling: (**12L)**
Types of Processor Scheduling, Scheduling Algorithms.
Multiprocessor and Real Time Scheduling: Multiprocessor Scheduling, Real Time Scheduling.

Embedded/ Real Time Operating systems: **(8L)**
Categories of Embedded Operating systems, Overview of Embedded/ Real Time Operating systems, Embedded/Real Time Operating System Concepts.

MicroC/OS – II, The Real Time Kernel: **(9L)**
Kernel Structure, Task Management
Textbook:
1. Operating Systems – William Stallings – Fourth Edition, Pearson Education (Chap 1 to 4)
2. Embedded / Real Time System – Dr. K.V.K.K Prasad, DreamTech Pub (Chp 5)
3. Micro/OS – II, the Real Time kernel – Jean J. Labrosse, Second Edition, CMP Books
Reference
1. Operating Systems Principles: Silberchatz, Galvin- Fifth Edition, Addison Wesley

Electronics Lab DSC 5: Operating System
PRACTICAL (minimum 15 practical's)

1. Introduction to shell commands
2. Shell Programming to find the largest of three numbers.
3. Shell Programming to sort numbers.
4. Shell Programming to find the factorial of a number.
5. Shell Programming to find the sum of the digits of a number.
6. Shell Programming to identify if a number is prime or composite.

7. Shell Programming to generate the prime numbers specified for a particular range.
8. Shell Programming to generate the Fibonacci series.
9. Shell Programming to calculate the sum and average of a given numbers using for loop and while loop.
10. Shell Programming to find the sum of odd natural numbers.
11. Shell Programming to find the sum of even natural numbers.
12. Shell Programming demonstrating Swapping of two numbers.
13. Shell Programming Display of Multiplication Tables for a given range.
14. Shell script using grep command.
15. Shell script using case construct.
16. Shell script using to find sum of a series.
17. Socket Programming 13- To transmit and receive a file.
18. Socket Programming 14- To Transmit a message, manipulate the data by counting the number of characters in the message
19. RTOS-1
20. RTOS-2

ELECTRONICS-DSC6: 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, Characteristics 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, Construction, 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 –DSC6: 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-DSC7: TRANSDUCER AND INSTRUMENTATION
(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

QUALITIES OF MEASUREMENTS: (6L)
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: (15L)
Electrical transducer: Characteristics, advantages, Selecting a Transducer, **Resistive Transducer:** Potentiometer, Resistance pressure transducer, Resistive Position Transducer, Resistance thermometer. **Strain Gauges:** Resistance wire Gauge (Unbounded 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: (08L)
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: (**10L)**
Basic principle, Block diagram of oscilloscope, **Types of CRO:** Principles of Dual beam and Dual Trace Oscilloscope, Analog storage Oscilloscope, DSO, Power scope: Block diagram, principle and working, Advantages and applications, CRO specifications (bandwidth, sensitivity, and rise time).

BRIDGES: (05L)
DC Bridges and applications: Wheatstone, Kelvin, And AC Bridges: General form of AC bridge balance, comparison bridges, Maxwell, Hay, Schering, Wien, LCR Bridge.

SIGNAL GENERATOR: (03L)
A.F Sine & Square Wave Generator, Function generator, Pulse Generator, Sweep Frequency generator.

WAVE ANALYZERS: (05L)
Basic wave analyzer, Frequency Selective Wave Analyzer, Heterodyne Wave Analyzer. Harmonic Distortion Analyzer, Spectrum Analyzer.

DIGITAL INSTRUMENTS: (08L)

Digital Voltmeters: Ramp type DVM, Dual Slope integrating type DVM, Staircase Ramp Type, Successive Approximation DVM, $3_{1/2}$ Digit, Resolution & Sensitivity of Digital Meters, Digital Multimeter, Digital Frequency meter.

Reference Books:

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

Laboratory experiments under –DSC7: TRANSDUCER AND INSTRUMENTATION

At least 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-DSC8: COMPUTER NETWORKS AND ADMINISTRATION
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

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

PHYSICAL LAYER **(4L)**
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 **(4L)**
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, Gigabit Ethernet, 10 Gigabit Ethernet.

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

Network Layer (**4L)**
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 **(3L)**
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 **(4L)**
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 (**3L)**
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 **(3L)**

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 **(2L)**

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

Introduction to server core: **(5L)**

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

Windows server 2012 R2 Networking Enhancements **(3L)**

Benefits of IPv6, networking manageability with PowerShell, microsoft NIC teaming, Enhanced QoS.

IP address management (**5L)**

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 (**5L)**

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 (**2L)**

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

Group policy (**2L)**

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

Files, folders and basic shares **(2L)**

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

Creating & managing shared folders: **(1L)**

Creating shared folders, managing permissions

Sharing printers on windows server 2012 R2 networks **(1L)**

Print services overview, installing the print and document 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: DSC8

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 sub netting
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

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ELECTRONICS-DSC9: BIOMEDICAL AND PHARMACEUTICAL INSTRUMENTATION
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Pharmaceutical Instrumentation: (06L)

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

Chemical Sensors: (05L)

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

Fundamentals of Medical Instrumentation: (06L)

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: (09L)

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: (06L)

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: (14L)

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: (04L)

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: (04L)

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

Non-Invasive Diagnostic Imaging: (06L)

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 DSC9 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 Ultrasonography.
8. Study of Oximeter
9. Measurement of respiration rate using thermistor.
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 thermistor.
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-DSC10: EMBEDDED SYSTEMS

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

UNIT 1: (10L)

Introduction of Microcontroller / Microprocessor architectures, The Texas Instrument's MSP430 Microcontrollers, Architecture: CPU, Memory Structure, RAM and Information memory, Variants and their hardware enhancements.

UNIT 2: (10L)

Resets and Interrupts: Resets, Interrupts and its uses, interrupt v/s Polling
Clocks and Timers: Sources, Controls Low power design: Power Consumption characteristics, Low Power modes Addressing modes: Register mode, Immediate mode, Symbolic mode, Absolute mode, Indexed mode, Indirect mode/ Indirect Auto-increment mode.

UNIT 3: (15 L)

Instruction set of MSP430: Basic Instruction set, Instruction format, I/O Port programming, Arithmetic & Logical Instructions.

UNIT 4: (25 L)

Real time interfacing I: 16x2 Alphanumeric LCD, 4 x 1 / 4x4 keypad, 7segment LED, RTC
Real time Interfacing II (Mixed signal interfaces): 10bit /12-bit SAR A/D converter, 12-bit D/A Converter
Real time interfaces III (Communication of data): UART, I2C, SPI

Reference Books:

1. Embedded Systems Design using the TI MSP430 Series Author: Chris Nagy Imprint Newness

2. MSP430 Microcontroller Basics Author: John Davies Imprint: Newness
3. User data manuals and Handbooks of TI MSP430

Laboratory experiments under –DSC10: EMBEDDED SYSTEMS

At Least 15 Experiments from The Following
Examples in Assembly & C in workable on IAR WORKBENCH

EMBEDDED SYSTEMS- LAB

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

Practical's in Assembly/C workable on IAR WORKBENCH

ELECTRONICS-DSE 1 or 2: PHOTONICS (ELD 115)

(Credits: Theory-03, Practicals-01)

Theory Lectures 45

Unit-1 (20 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 wave front, Young's double slit, Division of Amplitude, thin film interference, Newton's rings; Michelson interferometer.

Diffraction: Huygens Fresnel Principle, Diffraction Integral, Fresnel & 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 (12 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.

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 responsively.

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

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 1 or 2: PHOTONICS

At least 8 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. To determine the specific rotation of scan sugar using polarimeter.
8. To determine characteristics of LEDs (Radiation pattern, Power Vs. Current)
9. To measure the numerical aperture of an optical fiber.
10. Design of Photo detector circuit using OP-amp
11. Design of digital optical receiver using comparator
12. To determine characteristics Photo- detector (rise time, radiation pattern, Power Vs. Current)
13. Light coupling in optical fiber, Numerical aperture of Fiber

Reference Books:

1. J. Wilson and J. F. B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India

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

DSE 1 or 2: PROGRAMMING WITH MATLAB (ELD 115)

(Credits: Theory-03, Practicals-01)

Total Lectures: 45

CHAPTER 1: STARTING WITH MATLAB (6L)

Starting MATLAB, MATLAB Windows, working in the Command Window, And Arithmetic Operations with Scalars: Order of Precedence & Using MATLAB as a Calculator, Display Formats, Elementary Math Built-In Functions, Defining Scalar Variables: The Assignment Operator, Rules About Variable Names, Predefined Variables.

CHAPTER 2: CREATING ARRAYS (8L)

Creating a one-dimensional array (vector), Creating a two-dimensional array (matrix): The zeros, ones and eye Commands, Notes about variables in MATLAB, The transpose operator, **Array addressing:** vector &matrix, Using a colon: in addressing arrays, Adding elements to existing variables Deleting elements, Built-in functions for handling arrays, Strings and strings as variables.

CHAPTER 3: MATHEMATICAL OPERATIONS WITH ARRAYS (7L)

Addition and subtraction, Array multiplication, Array division, Element-by-element operations, using arrays in MATLAB built-in math functions, Built-in functions for analyzing arrays, Generation of Random Numbers

CHAPTER 4: SCRIPT FILES (5L)

Notes about Script Files, Creating and Saving a Script File, running a script file: Current directory & Search path, Global variables, Input to a script file, **Output commands:** The disp Command & The fprintf command.

CHAPTER 5: TWO-DIMENSIONAL PLOTS (6L)

The Plot Command: Plot of Given Data & Plot of a Function, the fplot command, Plotting Multiple Graphs in The Same Plot: Using the plot Command & Using the hold on, hold off Commands Using the line Command, **Formatting A Plot:** Formatting a Plot Using Commands & Formatting a Plot Using the Plot Editor, Histograms.

CHAPTER 6: FUNCTIONS AND FUNCTION FILES (5L)

Creating a function file, **Structure of a function file:** Function Definition Line, Input and Output Arguments, The H1 Line and Help Text Lines, Function Body, Local and global variables, saving a function file, Using a function file, Examples of simple function files, Comparison between script files and function files

CHAPTER 7: PROGRAMMING IN MATLAB (8L)

Relational and logical operators, **conditional statements:** The if-end Structure, the if-else-end Structure, the if-elseif-else-end Structure, the switch-case statement, loops**:** for-end loops, while-end loops, Nested loops and nested conditional statements, the break and continue commands.

Reference Books:

1. MATLAB: An Introduction with Applications, by Amos Gilat, 2nd edition, Wiley, 2004,
2. C.B. Moler, Numerical Computing with MATLAB, SIAM, 2004.

Laboratory experiments under DSE 1 OR 2:
AT LEAST 8 EXPERIMENTS FROM FOLLOWING.

1. Write a program to perform simple Calculations using MATLAB.
2. Write a program to perform Elementary math functions and Trigonometric math functions using MATLAB.
3. 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. $2\pi^2$
   c. $\sqrt{2}$
   d. $(0.0000123 + 5.67\times10^{-3}) \times 0.4567\times10^{-4}$
4. Write a program to convert Celsius temperatures 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.
5. Write a program to perform Matrix addition, subtraction and Multiplication for [3x 3] matrix.
6. Write a program to use the built in functions for analysing array.
7. Write a program to plot a graph for the given data.
8. Write a program to plot a graph using flpot command.
9. Write a program to plot a multiple graph using plot command.
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 program to display the first n terms of Fibonacci series.
14. Write a program to find factorial of the given number.
15. Write a function called F to C (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. F to C (96)
    ii. look for Fahrenheit
    iii. help F to C
16. Write a program using if-end Structure, if-else-end Structure, if-elseif-else-end Structure.
17. Write a program using switch-case statement.
18. Write a program using for-end loops and while-end loops
19. Write a program using Nested loops and nested conditional statements.

DSE 1 or 2: PROGRAMMING WITH SCILAB (ELD 125)
(Credits: Theory-03, Practicals-01)
Theory: 45 Lectures

Unit I- Introduction to Scilab: (10 L)
Why Scilab, Installing Scilab, Getting Started with Scilab: SCILAB Environment, Workspace, Working Directory, Expressions, Constants, Variables and assignment statement, Arrays.

Unit II- Graph Plots: (8L)
Basic plotting, built in functions, generating waveforms, Sound replay, load and save.

Unit III: **Matrix Operation** (6L)
Matrices and Some Simple Matrix Operations, Sub- Matrices.

Unit IV- (6L)
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 (5L)
Introduction to xcos, Calling User Defined Functions in XCOS

Reference Books:

1. M.Affouf, SCILAB by Example, Create Space Independent Publishing Platform,2012
2. H. Ramchandran, A.S. Nair, SCILAB, S. Chand, 2011

Laboratory experiments under DSE 1 OR 2:
AT LEAST 8 EXPERIMENTS FROM FOLLOWING.

1. Write a program to perform simple Calculations using Scilab.
2. Write a program to perform Elementary math functions and Trigonometric math functions using Scilab.
3. 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. $2\pi^2$
    c. $\sqrt{2}$
    d. $(0.0000123 + 5.67\times10^{-3}) \times 0.4567\times10^{-4}$
4. Write a program to convert Celsius temperatures 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.
5. Write a program to perform Matrix addition, subtraction and Multiplication for [3x 3] matrix.
6. Write a program to use the built in functions for analysing array.
7. Write a program to plot a graph for the given data.
8. Write a program to plot a graph using flpot command.
9. Write a program to plot a multiple graph using plot command.

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 program to display the first n terms of Fibonacci series.
14. Write a program to find factorial of the given number.
15. 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:
    iv. FtoC(96)
    v. look for Fahrenheit
    vi. help FtoC
16. Write a program using if-end Structure, if-else-end Structure, if-elseif-else-end Structure.
17. Write a program using switch-case statement.
18. Write a program using for-end loops and while-end loops
19. Write a program using Nested loops and nested conditional statements.

ELECTRONICS-DSE 3: INDUSTRIAL AUTOMATION (ELD 116)
(Credits: Theory-03, Practicals-01)
Theory: 45 Lectures

Unit 1 **(12 Lectures)**

Introduction to control systems; types of control systems, basic concept of open-loop and closed-loop control systems; Mathematical modelling and representation of mechanical (translational & rotational) and electrical systems Conversion of mechanical to analogous electrical systems (force-voltage and force current analogy); (Block diagrams, Signal flow graphs and transfer functions.

Unit 2 **(13 Lectures)**

Programmable Logic Controllers (PLC): PLC Advantages & Disadvantages, Overall PLC System, CPU, PLC input & Output Modules (Interfaces), General PLC Programming Procedure: Proper Construction of PLC Ladder diagrams, Process Scanning considerations, Devices to which PLC input & output are connected: Input ON/OFF switching devices, input analog devices, ON/OFF devices, Output analog devices, Basic PLC Programming: (i) Programming ON-OFF inputs to produce ON-OFF outputs: PLC input instructions, Outputs Coils, Indicators, Operational Procedures, Constant Coil input & output programming examples, Fail Safe circuits, Industrial Process Example. (ii) Relation of digital gate Logic to Contact /Coil Logic: Digital logic gates & PLC equivalents, Boolean Algebra PLC programming, Conversion Examples. (iii) Creating Ladder Diagrams from Process Control Descriptions: Ladder diagrams & Sequence listing, Large Process Ladder diagram construction. (iv) PLC Timer Functions: PLC timer functions, Examples of timer and their industrial applications, Industrial process timing applications. (v) PLC Counter functions: PLC Counters, Examples of Counter Functions, Industrial applications. (vi) Selecting a PLC: PLC versus Personal Computer, Factors to consider while selecting a PLC.

Unit 3 **(20 Lectures)**

Supervisory Control and Data acquisition (SCADA) Systems, Types of supervisory systems, concepts of 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
6. Control Systems-Principles and Design - M. Gopal, Tata Mc Graw Hill
7. Control Systems Engineering, – I.J. Nagrath and M. Gopal, The New Age International (P) Ltd., New Delhi
8. Modern Control Engineering—D. Roy Choudhry
9. Modern Control Engineering, -K.Ogala, PHI
10. Control Systems, -A.NagoorKani, RBA Publications, Chennai
11. Automatic Control Systems, - B.C.Kuo, PHI
12.Programmable Logic Controllers Principles and applications by John W. Webb and Ronald A. Reis 5thedition prentice Hall of India.

13. Programmable Logic Controllers and Industrial Automation by Madhuchhanda, Samarjit Sengupta Penram International Pub. Pvt. Ltd.

14.Programmable Logic Controllers Programming methods and applications by john r. Hackworth and Frederick D. Hackworth, Jr. Pearson education.

15. Programmable Logic Controllers by Frank Petuzella, Tata McGraw Hill Pub.

Laboratory experiments under -DSE 3: INDUSTRIAL AUTOMATION
(minimum 8 practicals’, 4 from PLC and 4 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
10. PLC ladder Program for logic functions: AND, OR, NAND, NOR and XOR.
11. PLC ladder Program to prove De Morgan’s theorem.
12. PLC ladder program for Multiple inputs and outputs.
13. PLC ladder Program for latching and unlatching functions.
14.PLC ladder Program using timers.
15.PLC ladder Program using counters.

16.PLC ladder Program to apply timer functions to process control.
17.PLC ladder Program to apply timer functions for control of industrial control.
18.PLC ladder Program to apply counter functions to process control.
19.PLC ladder Program to apply timer and counter functions to process control
20.PLC ladder Program using Master Control Relay function
21.PLC based application program for automatic indication for water tank level.
22.PLC based application program for traffic light indication.
23.PLC based application program forward and Rev direction of Motor.
24.PLC based application program for controlling Robot.
25.PLC based application program for ON/OFF control lights.
26.Interfacing Digital input and output device/s to PLC and writing a ladder program.
27.Interfacing Analog input and output device/s to PLC and writing a ladder program.

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.

DSE 3(SWAYAM)
SEC COURSES

ELECTRONICS SEC 1: PROGRAMMING in C++

(Credits: Theory-03, Practicals-01)

Theory Lectures: 45 lectures

Chapter 1: Flowcharts and Algorithms (1L)

Chapter 2: Data types, Operators and expressions (3L)
Identifiers, keywords, constants, C++ operators, Type conversion

Chapter 3: Writing a program in C++ (3L)
Declaration of variables, statements, and control statements – if statement and if – else statements, switch statements, loop statements: for loop, while loop and do-while loop, breaking control statements: break and continue statements, goto statement.

Chapter 4: Functions and Program Structures (4L)
Defining a function, return statement, types of functions, Actual and formal arguments, Local and Global arguments, Default arguments, Multifunction program, Storage class specifiers, Recursive functions, Pre-processors, Macro, header files and standard files.

Chapter 5: Arrays (3L)
Array notation, array declaration, array initialization, processing with an array, arrays and functions, Multidimensional arrays, Character arrays.

Chapter 6: Pointers (3L)
Pointer declaration, address operator, pointer variable, pointer expressions, pointer arithmetic, pointer and functions, pointers and arrays, pointers and strings, array of pointers and pointer to pointer.

Chapter 7: Structures (3L)
Structure declaration, structure definition, and structure initialization, accessing structure members, nesting of structures, array of structures, structures and functions

Chapter 8: Classes and Objects (5L)
Declaration of a class, member functions, defining the object of a class, accessing a member of a class, Array of class objects, Pointers and classes, classes within classes.

Chapter 9: Constructors and destructors (5L)
Constructors, Copy constructors, Parameterized constructors, multiple constructors, default constructors, destructors, inline member functions, Static class members (Static data members and static member functions), friend function, new and delete operators, this operator.

Chapter 10: Inheritance (5L)
Types of Inheritances, Types of base classes, derived class, types of inheritance.

Chapter 11: Operator overloading (5L)
Defining operator overloading, overloading unary operators, overloading binary operators.

Chapter 12: Polymorphism (5L)
Function overloading, early binding, Late binding, virtual functions, Pure virtual functions and Abstract base classes.

Text Book:
1. Object oriented programming with C++ E. Balaguruswamy TMH

REFERENCE BOOKS:
1. Mastering C++ K. R. Venugopal, Rajkumar, T. Ravishankar TMH
2. Programming with C++ D. Ravichandran TMH

Laboratory experiments under SEC1: Programming in C++

AT LEAST 8 EXPERIMENTS FROM FOLLOWING.

Practical List

1. To find the largest of three numbers.
2. Sum and average of n numbers.
3. Sum of the digits of a number using mod function.
4. Generation of Fibonacci series using functions and classes
5. Prime numbers

a) To identify whether a number is prime or composite.
b) To print prime numbers for a given range of numbers.

6. Sine series evaluation.
7. Sorting of n numbers using arrays
8. Programming using overloading
9. Programming using polymorphism
10. Programming using inheritance
11. Matrix multiplication
12. Addition of a number using Storage class specifiers
13. Factorial of a number using recursive functions
14. Swapping of a number using:
    a) Call by value
    b) Call by reference
15. Programming using class constructors and destructors
16. Programming to generate student identity cards using structures
17. Copy contents of two strings A and B into string C and count the number of characters present in string C.

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, Balaguruswamy, 2nd edition, TMH.

ELECTRONICS-SEC2: SMART PHONE APPS DEVELOPMENT

(Credits: 03, Practicals-01)

Theory Lectures: 45 lectures

UNIT-I (15L)

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.

UNIT-II (20L)

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 Call-back Methods, Handling Click Events, Touchscreen Events, Keyboard Events, Context Menus, Controlling the Focus.

UNIT-III (10L)

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, OnurCinar , Apress Publication
2. Professional Android 4 Application Development, Reto Meier, Wrox

Electronics Lab SEC2: SMART PHONE APPS DEVELOPMENT

PRACTICALS: (ANY 8)

1. Create ―Hello World‖ application. That will display ―Hello World‖ in the middle of the screen in the emulator. Also display ―Hello World‖ in the middle of the screen in the Android Phone.
2. Create- HELLO INDIA, when the button is clicked.
3. Create 4 buttons which displays four values.
4. Create an application with login module. (Check username and password).
5. Create spinner with strings taken from resource folder (res >> value folder) and on changing the spinner value, Image will change.
6. Create a menu with 5 options and and selected option should appear in text box.
7. Create a list of all courses in your college and on selecting a particular course teacher-in-charge of that course should appear at the bottom of the screen.
8. Create an application with three option buttons, on selecting a button color of the screen will change.
9. Create and Login application as above. On successful login, pop up the message.

GE Courses

GE 1: ELECTRONICS CIRCUITS AND PCB DESIGNING/ Consumer Electronics

(Credits: Theory-03, Practical: 01)
Theory: 45 Lectures

Unit-1 (9 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 (11 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 filters with waveforms.

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

Unit-3 (13 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, Zen and Zout.

Unit-4 (12 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, and 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 Photo printing: Properties of laminates, Types of Laminates, Manual cleaning process, Basic printing process for double sided PCB's, Photo resists, wet film resists, Coating process for wet film resists, Exposure and further process for wet film resists, Dry film resists

Etching and Soldering: Introduction, Etching machine, Etchant system. Principles of Solder connection, Solder joints, Solder alloys, Soldering fluxes. Soldering, Disordering 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, JoesephEdminister, 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.

LAB GE1: Electronics circuits and PCB designing

Practical's: (Any 8)

1. Familiarization with various controls and use of CRO, Power Supply, Function Generator and Multimeter.
2. Verification of Ohm's Law and Kirchhoff's Laws.
3. Verification of voltage division and current division Laws.
4. Familiarization of various Electronics components & Introduction to Bread board, Resistors (Colour codes) and values, Capacitors (various types), Inductors (various types), Diodes – Rectifier, Zener, LED, BJT
5. Verification of Thevenin's Theorem.
6. Verification of Norton's Theorem.
7. Verification of Superposition Theorem.
8. Verification of Maximum Power Transfer Theorem.
9. Characteristics of P-N junction diode.
10. Study of H.W. and F.W. Rectifiers (Ripple factor and wave forms).
11. Study of Bridge Rectifiers (Ripple factor and wave forms).
12. Study of the effect of adding capacitor filter to F.W.R. (Waveforms and Ripple factor calculations).
13. Zener diode Regulator circuit.
14. Input characteristics of BJT (CE configuration)
15. Output characteristics of BJT (CE configuration)
16. Verification of Transistor current gains (α & β).
17. Load line and Q-point of CE Amplifier.
18. Study of frequency response of CE amplifier- with and without CE (Emitter bypass cap.)

19. PCB designing for given circuit using manual method.
20. Circuit construction on the PCB of a given circuit (drilling, components mounting & soldering, etc.)
21. PCB designing for a given circuit using CAD tools.

GE - 1 Consumer Electronics
(Credits: Theory-03, Practicals-01)
Theory Lectures: 45

Unit -1 **(10 Lectures)**

Audio systems:

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

Unit-2 **(10 Lectures)**

TV and display systems:

Television standards, MP4 players, Set Top box, CATV and Dish TV, LCD, Plasma & LED TV. Projectors: DLP, Home Theatres, Remote Controls

Unit-3 **(15 Lectures)**

Landline, Mobile telephony and Cabling:

Basic landline equipment, Cordless. Intercom/ EPABX system. Mobile phones: GPRS & Bluetooth and Wi-Fi. Analysis and Comparison of 1G, 2G, 3G, 4G, 5G and 6G Telecom services, GPS Navigation system. Smart Phones Office Equipment: Scanners, Barcode / Flat bed, Printers, Xerox, Different types of Cables, Punching and crimping of cables.

Unit-4 **(10 Lectures)**

Electronic Gadgets and Domestic Appliances:

Digital clock, Digital camera, Handicam, Home security system, CCTV. Air conditioners, Refrigerators, Washing Machine/Dish Washer, Microwave oven, Vacuum cleaners

Suggested Books:

1. R. P. Bali Consumer Electronics Pearson Education (2008)
2. R. G. Gupta Audio and Video systems Tata McGraw Hill (2004)

Laboratory experiments under: GE1: Consumer Electronics
At least 8 experiments from following list
Practical List

1. Punching and crimping of cables
2. Study of Microphone
3. Study of Amplifier
4. Study of Loud speaker
5. Study of AM Radio receivers
6. Study of FM Radio receivers

7. Study of a PA system
8. Audio recording, reproduction and rendering of sound signals
9. Study of Set top box
10. Study of Home theatre system
11. Study of a Projector
12. Study of a Landline equipment
13. Study of a Mobile equipment
14. Study of a Digital clock
15. Study of a Digital camera
16. Study of a Handicap system
17. CCTV installations and cabling
18. Study of an Air conditioner system
19. Study of a Washing machine system
20. Study of a Dish washer system
21. Study of a Microwave oven system
22. Study of a Vacuum cleaner system

GE 2: REPAIR AND MAINTENANCE OF ELECTRICAL AND ELECTRONIC APPLIANCES/Medical Home Instruments
(Credits: 03, Practical :01)
Total Lectures 45

UNIT I **(12L)**
INTRODUCTION TO ELECTRICITY

Line Voltage: -Distribution, Mains supply standards, Meaning of Single phase and three phase supply, conventions followed. Importance of earthing and fuse: Introduction of Earthing, need of earthing, Hazard, Types of earthing, Advantage of earthing, working of earthing, Importance of fuse, types of fuse. HOUSE WIRING: Introduction of Wiring, types of wiring, advantage of wiring, wiring methods, electrical panel, House wiring diagram.

UNIT II **(5L)**
Energy Consumption and Preventive Maintenance
General Precautions, handling and maintenance for all types of electrical and electronic domestic Appliances, Energy consumption. Energy meter: Introduction, working, Connection and Energy meter reading: Power Calculation of Load, Electricity Bill calculation

UNIT III (**7L)**
HEATING APPLIANCES:
Electrical iron, Electric stove, Electric Toaster, Immersion heater, Electric geyser, Electric Oven, Induction Cooktop, Electric Roti Maker, Electric Kettle, Ordinary and automatic iron:-Introduction, working principle, construction, operation, Installation, Maintenance and Repair (fault-finding and removal of faulty component)

UNIT IV **(7L)**

MOTORIZED APPLIANCES:
Electric fan (Ceiling Fan and Table Fan), Electric Mixer grinder, juicer, Electric washing machine, Hairdryer, Vacuum cleaner:-Introduction, working principle, construction, operation, Installation, Maintenance and Repair (fault-finding and removal of faulty component)

UNIT V **(7L)**

Electrical and electronic appliances

Electric gas lighter, Electric bell and buzzer, Emergency light, Voltage Stabilizer (Relay based), Linear Regulated Power Supply, Battery Charger, Solar Voltaic cell, Tube light: Introduction, working principle, construction, operation, Installation, Maintenance and Repair (fault-finding and removal of faulty component)

UNIT VI **(7L)**

Visual electronic appliances

Introduction, block diagram, working principal and different sections of Public address system, CD/DVD player, LCD/LED Television

LAB GE2: Repair and Maintenance of Electrical and Electronic Appliances:(any 8)

1. Use of tong tester, tester, Multimeter for measurement of Voltage, Current, Resistance and Continuity test.
2. Dismantling and reassembling of ordinary/automatic iron, Testing and repair of ordinary/automatic iron
3. Dismantling and reassembling of electric stove and hot plate, Testing and repair of electric stove and hot plate
4. Dismantling and reassembling of Induction cooktop, Testing and repair of Induction cooktop
5. Dismantling and reassembling of Electric Kettle, Testing and repair of Electric Kettle
6. Construction of Electric Extension board, Testing and repair of extension board
7. Dismantling and reassembling of electric oven, Testing and repair of electric oven
8. Dismantling and reassembling of electric toaster, Testing and repair of electric toaster.
9. Dismantling, assembling and testing of immersion heater and installation of geyser.
10. Testing, fault-finding, repair and overhauling of electric fan
11. Testing, faultfinding, repair and overhauling of electric mixer
12. Testing, faultfinding, repair and overhauling of non-automatic agitator type washing machine
13. Testing, faultfinding, repair and overhauling of hair dryer
14. Testing, faultfinding, repair and overhauling of vacuum cleaner
15. Testing, faultfinding, repair and overhauling of grain grinder

16. Dismantling, assembling, testing and repair of electric gas lighter
17. Testing, faultfinding and repairs of electric bell.
18. Testing, faultfinding and repair of emergency light.
19. Testing, faultfinding and repair of stabilizer.
20. Dismantling, assembling and study of various sections of LCD/LED TV
21. Dismantling, assembling and repair of battery charger / adaptor
22. To measure voltages/signals at various test points of public address system.
23. To study installation of DTH.
24. Tube light wiring
25. Installation and Testing of Ear thing.
26. Installation of Basic Single phase wiring as per the given wiring diagram.

Reference Books

1. The *Repair & Maintenance of Electrical Equipment*: A Complete Guide to Troubleshooting Portable *Electric* Tools and Generators. Front Cover. Fred Sotcher.

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

GE2: Medical Home instrumentation

(Credits: 03, Practical :01) Total Lectures 45

Fundamentals of Medical Instrumentation: (**7L)**
Anatomy and Physiology, 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: (12L)
Origin of Bio Electric Signals: Electrocardiogram, Electroencephalogram, and electromyogram, Recording Electrodes: Electrode tissue interface, Skin contact impedance, Silver – Silver Chloride electrodes, Electrodes for ECG, Electrodes for EEG, Electrodes for EMG, Electrical conductivity of electrodes jellies and creams, Microelectrodes: Glass micro capillary electrodes, Metal Microelectrodes.

Physiological transducers: (8L)
Introduction, Classification of Transducers, performance characteristics of Transducers: static and dynamic characteristics, signals from cardiovascular system, signals from respiratory system and the various types of transducers required to measure a given parameter, Optical fibre sensors: types of optical fibre sensors, Biosensors, Smart sensors

Recording Systems: (2L)

Basic recording system, General considerations for signal conditioners, Writing systems.

Biomedical Recorders: (5L)
Working principles of Electrocardiograph (ECG), ECG leads Electroencephalograph (EEG) and Electromyography (EMG) (qualitative study only). **Phonocardiograph**: origin of heart sounds, Microphones for Phonocardiography.

Patient Monitoring Systems: (6L)
Measurement of heart rate, Measurement of pulse rate, Blood pressure measurement: In-direct Methods of blood Pressure measurement: automatic blood pressure measuring using Korotkoff's method. Measurement of respiration rate: thermistor method, Pulse oximeter, Working principle of cardiac pacemaker.

Non- Invasive Diagnostic Imaging: (5L)
Working principles of X-rays, CT scan, Magnetic Resonance Imaging and Ultra-Sound Imaging.

1. Handbook of Biomedical Instrumentation By R.S. Khandpur, TMH, 2nd Edn
2. Medical Instrumentation- Application & Design, By John Webster, 3rd Edition, Wiley India Edi.
3. Biomedical Instrumentation and Measurements by Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer PHI (2nd Edition)
4. Principles of applied biomedical instrumentation by Goddes& Baker, Jonh Wiley
5. Medical Electronics and Instrumentation by Sanjay Guha, University publication.
6. Textbook of Medical Instruments, By S. Ananthi New Age International.

Practical's: (At least 8 Experiments)
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 Bio-Medical transducers for bio-medical applications.
7. Study of Oximeter.
8. Bio-Medical application using transducer I.
9. Bio-Medical application using transducer II.
10. Study of Bio- Medical transducers
11. Study of Bio- Medical transducers
12. Study of electrical conductivity of electrodes and jellies / creams
13. Study of Pulse Rate
14. Study of Heart beat Meter.
15. Study of cardiac pacemaker
16. Study of ultrasonography
17. Study of oximeter
18. Measurement of Body temperature