CHOICE BASED CREDIT SYSTEM

Syllabus for B. Sc. With

Electronics

as a discipline of choice

West Bengal State University

Syllabus and Scheme of Examination

for

B.Sc. with Electronics

General

Course StructureDetails of course under B.Sc.Electronics General

Course	Credits
I. Core Course (12 Papers)	
Core Course Theory **(04 Papers of 4 Credit from each of 3 Discipline)**	12×4=48
Core Course Practical**(04 Papers of 2 Credit from each of 3 Discipline)**	12×2=24
II. Elective Course (6 Papers)	
A.1. Theory **(2 Papers of 4 Credit each from each Discipline of Choice)**	6×4=24
A.2. Practical**(2 Papers of 4 Credit each from each Discipline of Choice)**	6×2=12
III. Ability Enhancement Courses	
1. Ability Enhancement Compulsory Courses (AECC)	
Environmental Science**(1 Paper of 2 Credit)**	1×2=02
English/MIL Communication**(1 Paper of 2 Credit)**	1×2=02
2. Skill Enhancement Courses (SEC)	
4 Papers**(4 Papers of 2 credit each)**	4×2=08
TOTAL CREDIT	120

Scheme for Choice Based Credit System in B.Sc with Electronics General

Semester	CORE COURSE (CC)	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)
I	ELSGCOR01T **Network Analysis and Analog Electronics**	Environmental Science		
	DSC- 2A			
	DSC- 3A			
II	ELSGCOR02T **Linear and Digital Integrated Circuits**	English/ MIL Communication		
	DSC-2B-			
	DSC-3B			
III	ELSGCOR03T **Communication Electronics**		**SEC-1**	
	DSC-2C-			
	DSC-3C-			
IV	ELSGCOR04T **Microprocessor and Microcontrollers**		**SEC-2**	
	DSC-2D-			
	DSC-3D-			
V			**SEC-3**	**DSE-1A**
				DSE-2A
				DSE-3A
VI			**SEC-4**	**DSE-1B**
				DSE-2B
				DSE-3B

SEMESTER-WISE SCHEDULE FOR B.Sc. (GENERAL) ELECTRONICS

	Course Opted	Course Name	Credits
SEMESTER-I	Ability Enhancement Compulsory Course -1	Environmental Science	2
	Core Course-I	Network Analysis and Analog Electronics	4
	Core Course-I Practical	Network Analysis and Analog Electronics **Lab**	2
	Core Course-II	DSC-2A	6
	Core Course-II	DSC-3A	6
Semester Total			20

	Course Opted	Course Name	Credits
SEMESTER-II	Ability Enhancement Compulsory Course -1	English/ MIL Communication	2
	Core Course-IV	Linear and Digital Integrated Circuits	4
	Core Course-IV Practical	Linear and Digital Integrated Circuits **Lab**	2
	Core Course-V	DSC-2B	6
	Core Course-VI	DSC-3B	6
Semester Total			20

	Course Opted	Course Name	Credits
SEMESTER-III	Core Course-VII	Communication Electronics	4
	Core Course-VII Practical	Communication Electronics **Lab**	2
	Core Course-VIII	DSC-2C	6
	Core Course-IX	DSC-3C	6
	Skill Enhancement Course-1	SEC-1	2
Semester Total			20

	Course Opted	Course Name	Credits
SEMESTER-IV	Core Course-X	Microprocessor and Microcontrollers	4
	Core Course-X Practical	Microprocessor and Microcontrollers **Lab**	2
	Core Course-XI	DSC-2D	6
	Core Course-XII	DSC-3D	6
	Skill Enhancement Course-2	SEC-2	2
Semester Total			20

	Course Opted	Course Name	Credits
SEMESTER-V	Skill Enhancement Course-3	SEC-3	2
	Discipline Specific Elective-1	**DSE-1A**	6
	Discipline Specific Elective-2	DSE-2A	6
	Discipline Specific Elective-3	DSE-3A	6
Semester Total			20

	Course Opted	Course Name	Credits
SEMESTER-VI	Skill Enhancement Course-4	SEC-4	2
	Discipline Specific Elective-4	**DSE-1B**	6
	Discipline Specific Elective-5	DSE-2B	6
	Discipline Specific Elective-6	DSE-3B	6
Semester Total			20

B.Sc. with **Electronics**

CORE PAPER(CP1-4): (Credit: 06 each) (1 period/week for tutorials or 4 periods/week for practical)
1. Network Analysis and Analog Electronics + Lab 2. Linear and Digital Integrated Circuits + Lab 3. Communication Electronics + Lab 4. Microprocessor and Microcontrollers + Lab

Discipline Specific Electives (DSE): (Credit: 06 each) (2 papers to be selected) - DSE 1-2	
1. Verilog and FPGA based system Design + Lab 2. Antenna Theory and wireless Network + Tutorial	**Select one in Semester-V**
3. Photonic devices and Power Electronics + Lab 4. Electronic Instrumentation + Lab	**Select one in Semester-VI**

Skill Enhancement Course (SEC) (04 papers) (Credit: 02 each) - SEC1 to SEC4		
1.	Design and Fabrication of Printed Circuit Boards	**Semester-III**
2.	Robotics	**Semester-IV**
3.	Design and Fabrication of Printed Circuit Boards	**Semester-V**
4.	Robotics	**Semester-VI**

CBCS Syllabus for B.Sc. with Electronics

CORE PAPERS

SEMESTER	I	TYPE	CORE (THEORY)	CODE	ELSGCOR01T	CREDITS	04
NAME	Network Electronics and Analog Circuits					LECTURES	60

Unit 1 **Lectures 18**

- Circuit Analysis: 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. (14 Lectures)
- Junction Diode and its applications: 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 (center 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. (18 Lectures)

Unit 2 **Lectures 17**

- Bipolar Junction Transistor: Review of the characteristics of transistor in CE and CB configurations, Regions of peration (active, cut off and saturation), Current gains α and
- β. Relations between α and β. dc load line and Q point. (5 Lectures)
- Amplifiers: 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. (10 Lectures)
- Cascaded Amplifiers: Two stage RC Coupled Amplifier and its Frequency Response.(2 Lectures)

Unit 3 **Lectures 07**

- Feedback in Amplifiers: Conceptof feedback, negative and positive feedback, advantages of negative feedback (Qualitative only). (2 Lectures)
- Sinusoidal Oscillators: Barkhausen criterion for sustained oscillations. Phase shift and Colpitt's oscillator. Determination of Frequency and Condition of oscillation. (5 Lectures)

Unit 4 **Lectures 04**

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

Suggested 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)

SEMESTER	I	TYPE	CORE (PRACTICAL)	CODE	ELSGCOR01P	CREDITS	02
NAME	Network Analysis and Analog Electronics Lab					LECTURES	60

AT LEAST 06 EXPERIMENTS FROM THE FOLLOWING BESIDES #1

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.

Suggested 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)
4. Allen Mottershead, Electronic Devices and Circuits, Goodyear Publishing Corporation.

SEMESTER	II	TYPE	CORE (THEORY)	CODE	ELSGCOR02T	CREDITS	04
NAME	Linear and Digital Integrated Circuits					LECTURES	60

Unit 1 **Lectures 14**

- Operational Amplifiers (Black box approach): 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. (5 Lectures)
- Applications of Op-Amps: (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). (12 Lectures)
- Number System and Codes: 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.(9 Lectures)

Unit 2 **Lectures 28**

- Number System and Codes: 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.*(9 Lectures)*
- Logic Gates and Boolean algebra: Truth Tables of OR, AND, NOT, NOR, NAND, XOR, XNOR, Universal Gates, Basic postulates and fundamental theorems of Boolean algebra.(4 Lectures)
- Combinational Logic Analysis and Design: Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP).*(5 Lectures)*
- Arithmetic Circuits: Binary Addition. Half and Full Adder. Half and Full Subtractor, 4-bit binary Adder/Subtractor.*(3 Lectures)*
- Data processing circuits: Multiplexers, De-multiplexers, Decoders, Encoders. (3 Lectures)

Unit 3 **Lectures 24**

- Clock and Timer (IC 555): Introduction, Block diagram of IC 555, Astable and Monostablemultivibrator circuits.*(3 Lectures)*
- 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: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits). *(2 Lectures)*
- Counters (4 bits): Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter.*(4 Lectures).*

Unit 4 **Lectures 6**

- D-A and A-D Conversion: 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*).(4 Lectures).*

Suggested 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 Hill
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.
   Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994

SEMESTER	II	TYPE	CORE (PRACTICAL)	CODE	ELSGCOR02P	CREDITS	02
NAME	Linear and Digital Integrated CircuitsLab					LECTURES	60

At least 04 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 AstableMultivibrator of given specification using IC 555 Timer.
7. To design a MonostableMultivibrator 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.

Suggested 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. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
4. Digital Electronics, S.K. Mandal, 2010, 1st edition, McGraw Hill

SEMESTER	III	TYPE	CORE (THEORY)	CODE	ELSGCOR03T	CREDITS	04
NAME	Communication Electronics					LECTURES	60

Unit 1 **Lectures 14**

- Electronic communication: 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. (8 Lectures)

Unit 2 **Lectures 28**

- Analog Modulation: 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 *(12 Lectures)*
- Analog Pulse Modulation: Channel capacity, Sampling theorem, Basic Principles-PAM, PWM, PPM, modulation and detection technique for PAM only, Multiplexing. *(9 Lectures)*

Unit 3 **Lectures 24**

- Digital Pulse Modulation: 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).(10 Lectures)

Unit 4 **Lectures 6**

- Introduction to Communication and Navigation systems: 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. *(10 Lectures)*
- Mobile Telephony System – 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*).(10 Lectures)*
- GPS navigation system (qualitative idea only*) (1 Lecture)*

Suggested 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.
   Wireless communications, Andrea Goldsmith, 2015, Cambridge University Press

SEMESTER	III	TYPE	CORE (PRACTICAL)	CODE	ELSGCOR03P	CREDITS	02
NAME	**Communication Electronics Lab**					LECTURES	60

AT LEAST 03 AND 05 EXPERIMENTS RESPECTIVELY FROM FOLLOWING USING HARDWARE AND SIMULATIONS

1. To design an Amplitude Modulator using Transistor
2. To study envelope detector for demodulation of AM signal
3. To study FM - Generator and Detector circuit
4. To study AM Transmitter and Receiver
5. To study FM Transmitter and Receiver
6. To study Time Division Multiplexing (TDM)
7. To study Pulse Amplitude Modulation (PAM)
8. To study Pulse Width Modulation (PWM)
9. To study Pulse Position Modulation (PPM)
10. To study ASK, PSK and FSK modulators

Suggested Books

1. Electronic Communication systems, G. Kennedy, 1999, Tata McGraw Hill.
2. Electronic Communication system, Blake, Cengage, 5th edition.

SEMESTER	IV	TYPE	CORE (THEORY)	CODE	ELSGCOR04T	CREDITS	04
NAME	**Microprocessor and Microcontroller**					LECTURES	60

Unit 1 **Lectures 23**

- Microcomputer Organization: Input/Output Devices. Data storage (idea of RAM and ROM). Computer memory. Memory organization & addressing. Memory Interfacing. Memory Map.*(5 Lectures)*
- 8085 Microprocessor Architecture: Main features of 8085. Block diagram. Pin-out diagram of 8085. Data and address buses. Registers. ALU. Stack memory. Program counter.*(8 Lectures)*
- 8085 Programming : 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. *(10 Lectures)*

Unit 2 **Lectures 32**

- 8051 microcontroller: 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. (12 Lectures)
- 8051 I/O port programming: 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. (5 Lectures)
- 8051 Programming: 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.(15 Lectures)

Unit 3 **Lectures 05**

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

SEMESTER	IV	TYPE	CORE (PRACTICAL)	CODE	ELSGCOR04P	CREDITS	02
NAME	Microprocessor and Microcontroller Lab					LECTURES	60

At least 06 experiments each from Section-A and 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.
   Other programs (e.g. Parity Check, using interrupts, etc.).

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.
    Application of embedded systems: Temperature measurement & display on LCD

Suggested 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.8051 microcontrollers, Satish Shah, 2010, Oxford University Press.
4. Embedded Microcomputer systems: Real time interfacing, J.W. Valvano 2011, Cengage Learning

CBCS Syllabus for B.Sc. with Electronics

DISCIPLINE SPECIFIC ELECTIVE PAPERS

any one papers (06 credits each)

SEMESTER	V	TYPE	DSE (THEORY)	CODE	ELSGDSE01T	CREDITS	04
NAME	Verilog & FPGA based system design					LECTURES	60

Unit 1 **Lectures 20**

- Digital logic design flow. 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. (20 lectures)

Unit 2 **Lectures 20**

- Evolution of Programmable logic devices. 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. (20 lectures)

Unit 3 **Lectures 20**

- Verilog HDL: 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.(20 lectures)

Suggested 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. ZainalabedinNavabi. 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.

SEMESTER	V	TYPE	DSE (PRACTICAL)	CODE	ELSGDSE01P	CREDITS	02
NAME	Verilog & FPGA based system design Lab					LECTURES	60

AT LEAST 08 EXPERIMENTS FROM FOLLOWING

1. Write code to realize basic and derived logic gates.
2. Half adder, Full Adder using basic and derived gates.
3. Half subtractor and Full Subtractor using basic and derived gates.
4. Design and simulation of a 4 bit Adder.
5. Multiplexer (4x1) and Demultiplexer using logic gates.
6. Decoder and Encoder using logic gates.

7. Clocked D, JK and T Flip flops (with Reset inputs)
8. 3-bit Ripple counter
9. To design and study switching circuits (LED blink shift)
10. To design traffic light controller.
11. To interface a keyboard
12. To interface a LCD using FPGA
13. To interface multiplexed seven segment display.
14. To interface a stepper motor and DC motor.
15. To interface ADC 0804.

Suggested Books

1. W.Wolf, FPGA- based System Design, Pearson, 2004
2. U. Meyer Baese, Digital Signal Processing with FPGAs, Springer, 2004
3. S. Palnitkar, Verilog HDL– A Guide to Digital Design & Synthesis, Pearson, 2003
4. Verilog HDL primer- J. Bhasker. BSP, 2003 II edition

SEMESTER	V	TYPE	DSE (THEORY)	CODE	ELSGDSE02T	CREDITS	05
NAME	Antenna Theory and Wireless Networks					LECTURES	75

Unit 1 **Lectures 43**

ANTENNA THEORY:

- Introduction: Antenna as an element of wireless communication system, Antenna radiation mechanism, Types of antennas, Fundamentals of EMFT: Maxwell's equations and their applications to antennas. (7 Lectures)
- Antenna Parameters: Antenna parameters: Radiation pattern (polarization patterns, Field and Phase patterns), Field regions around antenna, Radiation intensity, Beam width, Gain, Directivity, Polarization, Bandwidth, Efficiency and Antenna temperature. (9 Lectures)
- Antenna as a Transmitter/Receiver: Effective Height and Aperture, Power delivered to antenna, Input impedance. Radiation from an infinitesimal small current element, Radiation from an elementary dipole (Hertzian dipole), Reactive, Induction and Radiation fields, Power density and radiation resistance for small current element and half wave dipole antenna. (12 Lectures)
- Radiating wire Structures (Qualitative idea only): Monopole, Dipole, Folded dipole, Loop antenna and Biconical broadband Antenna. Basics of Patch Antenna and its design. Examples of Patch antenna like bowtie, sectoral, fractal, etc. (6 Lectures)
- Propagation of Radio Waves: Different modes of propagation: Ground waves, Space waves, Space Wave propagation over flat and curved earth, Optical and Radio Horizons, Surface Waves and Troposphere waves, Ionosphere, Wave propagation in the Ionosphere. Critical Frequency, Maximum usable frequency (MUF), Skips distance. Virtual height. Radio noise of terrestrial and extraterrestrial origin. Elementary idea of propagation of waves used in Terrestrial mobile communications. (9 Lectures)

Unit 2 **Lectures 32**

WIRELESS NETWORKS:

- Introduction: History of wireless communication, Wireless Generation and Standards, Cellular and Wireless Systems, Current Wireless Systems, Cellular Telephone Systems, Wide Area Wireless Data Services, Broadband Wireless Access, Satellite Networks, Examples of

Wireless Communication Systems. Idea about Global Mobile communication system. (10 Lectures)

- Modern Wireless Communication Systems: Second Generation (2G) Cellular Networks, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL), Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANs). Idea about Wi-Fi, 4G and LTE, and 5G. (10 Lectures)
- Cellular Concept and System Design Fundamentals: Cellular Concept and Cellular System Fundamentals, Frequency Reuse, Channel Assignment Strategies, Handoff strategies, Interference and System Capacity, Trunking and Grade of Service. Improving Coverage &Capacity in Cellular Systems. Cell Splitting and Sectoring. Cellular Systems design Considerations (Qualitative idea only). (12 Lectures)

Suggested Books

1. Ballanis, Antenna Theory, John Wiley & Sons, (2003) 2nd Ed.
2. Jordan and Balmain, E. C., Electro Magnetic Waves and Radiating Systems, PHI, 1968 Reprint (2003) 3rd Ed.
3. Andrea Goldsmith, Wirelerss communications, (2015) Cambridge University Press
4. D. Tse and P. Viswanathan, Fundamentals of Wireless Communication, (2014) Cambridge University Press.
5. Wireless communication and Networks, UpenaDala, 2015, Oxford University Press.
6. Antenna and Wave Propagation, Yadava, PHI Learning.
7. Haykin S. &Moher M., Modern Wireless Communication, Pearson, (2005) 3rd Ed.
8. Lee, William C.Y., Mobile Communciation Design and Fundamentals, (1999) 4th Ed

SEMESTER	V	TYPE	DSE (TUTORIAL)	CODE	ELSGDSE02P	CREDITS	01
NAME	**Antenna Theory and Wireless Networks Tutorial**					LECTURES	

SEMESTER	VI	TYPE	DSE (THEORY)	CODE	ELSGDSE03T	CREDITS	04
NAME	**Photonic Devices and Power Electronics**					LECTURES	60

Unit 1 **Lectures 36**

PHOTONIC DEVICES:

- Classification of photonic devices. Interaction of radiation and matter, Radiative transition and optical absorption. Light Emitting Diodes- Construction, materials and operation. Semiconductor Laser- Condition for amplification, laser cavity, hetero-structure and quantum well devices. Charge carrier and photon confinement, line shape function. Threshold current. Laser diode. (12 Lectures)
- Photodetectors: Photoconductor. Photodiodes (p-i-n, avalanche) and Photo transistors, quantum efficiency and esponsivity. Photomultiplier tube. (5 Lectures)
- Solar Cell: Construction, working and characteristics (2 Lectures)
- LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays, applications, advantages over LED displays. (4 Lectures)
- Introduction to Fiber Optics: Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations -Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes -

Single Mode Fibers-Graded Index fiber structure. (13 Lectures)

Unit	2	Lectures	24

Power Devices:

- Need for semiconductor power devices, Power MOSFET (Qualitative). Introduction to family of thyristors. Silicon Controlled Rectifier (SCR)- structure, I-V characteristics, Turn-On and Turn-Off characteristics, ratings, Gate-triggering circuits. Diac and Triac- Basic structure, working and V-I characteristics. Application of Diac as a triggering device for Triac. (10 Lectures)
- Insulated Gate Bipolar Transistors (IGBT): Basic structure, I-V Characteristics, switching characteristics, device limitations and safe operating area (SOA). (2 Lectures)
- Applications of SCR: Phase controlled rectification, AC voltage control using SCR and
- Triac as a switch. Power Invertors- Need for commutating circuits and their various types,dc link invertors, Parallel capacitor commutated invertors, Series Invertor, limitations and its improved versions, bridge invertors. (12 Lectures)

Suggested Books

1. J. Wilson & J.F.B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India (1996)
2. S.O. Kasap, Optoelectronics & Photonics, Pearson Education (2009)
3. AK Ghatak& K Thyagarajan, Introduction to fiber optics, Cambridge Univ. Press (1998)
4. Power Electronics, P.C. Sen, Tata McGraw Hill
5. Power Electronics, M.D. Singh & K.B. Khanchandani, Tata McGraw Hill
6. Power Electronics Circuits, Devices & Applications, 3rd Edn., M.H. Rashid, Pearson Education
7. Optoelectronic Devices and Systems, Gupta, 2nd edn., PHI learning.
8. Electronic Devices and Circuits, David A. Bell, 2015, Oxford University Press.

SEMESTER	VI	TYPE	DSE (PRACTICAL)	CODE	ELSGDSE03P	CREDITS	02
NAME	Photonic Devices and Power Electronics Lab					LECTURES	60

AT LEAST 06 EXPERIMENTS FROM THE FOLLOWING

1. To determine wavelength of sodium light using Michelson's Interferometer.
2. Diffraction experiments using a laser.
3. Study of Electro-optic Effect.
4. To determine characteristics of (a) LEDs, (b) Photo voltaic cell and (c) Photo diode.
5. To study the Characteristics of LDR and Photodiode with (i) Variable Illumination intensity, and (ii) Linear Displacement of source.
6. To measure the numerical aperture of an optical fiber.
7. Output and transfer characteristics of a power MOSFET.
8. Study of I-V characteristics of SCR
9. SCR as a half wave and full wave rectifiers with R and RL loads.
10. AC voltage controller using TRIAC with UJT triggering.
11. Study of I-V characteristics of DIAC
12. Study of I-V characteristics of TRIAC

Suggested Books

1. A K Ghatak& K Thyagarajan, Introduction to fiber optics, Cambridge Univ. Press (1998)
2. Power Electronics, M.D. Singh & K.B. Khanchandani, Tata McGraw Hill
3. Power Electronics Circuits, Devices & Applications, 3rd Edn., M.H.Rashid, Pearson Education
4. A Textbook of Electrical Technology-Vol-II, B.L. Thareja, A.K. Thareja, S.Chand.

SEMESTER	VI	TYPE	DSE (THEORY)	CODE	ELSGDSE04T	CREDITS	04
NAME	Electronic Instrumentation					LECTURES	60

Unit 1 **Lectures 18**

- Measurements: Accuracy and precision. Significant figures. Error and uncertainty analysis. Shielding and grounding. Electromagnetic interference.(4 Lectures)
- Basic Measurement Instruments: DC measurement-ammeter, voltmeter, ohm meter, AC measurement, Digital voltmeter systems (integrating and non-integrating). Digital Multimeter; Block diagram principle of measurement of I, V, C. Accuracy and resolution of measurement. Measurement of Impedance- A.C. bridges, Measurement of Self Inductance (Anderson's bridge), Measurement of Capacitance (De Sauty's bridge), Measurement of frequency (Wien's bridge).(14 Lectures)

Unit 2 **Lectures 15**

- Power supply: Block Diagram of a Power Supply, Qualitative idea of C and L Filters. IC Regulators (78XX and 79XX), Line and load regulation, Short circuit protection. Idea of switched mode power supply (SMPS) and uninterrupted power supply (UPS).(5 Lectures)
- Oscilloscope: Block Diagram, CRT, Vertical Deflection, Horizontal Deflection. Screens for CRT, Oscilloscope probes, measurement of voltage, frequency and phase by Oscilloscope. Digital Storage Oscilloscopes. LCD display for instruments. (10 Lectures)

Unit 3 **Lectures 11**

- Lock-in-amplifier: Basic Principles of phase locked loop (PLL), Phase detector (XOR & edge triggered), Voltage Controlled Oscillator (Basics, varactor), lock and capture. Basic idea of PLL IC (565 or 4046). Lock-in-amplifier, Idea of techniques for sum and averaging of signals. (8 Lectures)
- Signal Generators: Function generator, Pulse Generator, (Qualitative only).(3 Lectures)

Unit 4 **Lectures 16**

- Virtual Instrumentation: Introduction, Interfacing techniques (RS 232, GPIB, USB), Idea about Audrino microcontroller and interfacing software like lab View).(5 Lectures)
- Transducers: Classification of transducers, Basic requirement/characteristics of transducers, Active and Passive transducers, Resistive (Potentiometer- Theory, temperature compensation & applications), Capacitive (variable air gap type), Inductive (LVDT) & piezoelectric transducers. Measurement of temperature (RTD, semiconductor IC sensors), Light transducers (photo resistors & photovoltaic cells).(11 Lectures)

Suggested Books

9. W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice Hall (2005).
10. E.O. Doebelin, Measurement Systems: Application and Design, McGraw Hill Book - fifth Edition (2003).
11. David A. Bell, Electronic Devices and Circuits, Oxford University Press (2015).
12. Alan S. Morris, “Measurement and Instrumentation Principles”, Elsevier (Butterworth Heinmann-2008).
13. S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mcgraw

Hill (1998).
14. Introduction to measurements and instrumentation, 4th Edn., Ghosh, PHI Learning

SEMESTER	VI	TYPE	CORE (PRACTICAL)	CODE	ELSGDSE04P	CREDITS	02
NAME	**Electronic Instrumentation Lab**					LECTURES	60

AT LEAST 05 EXPERIMENTS FROM THE FOLLOWING

1. Measurement of resistance by Wheatstone bridge and measurement of bridge sensitivity.
2. Measurement of Capacitance by De Sauty's bridge
3. To determine the Characteristics of resistance transducer - Strain Gauge (Measurement of Strain using half and full bridge.)
4. To determine the Characteristics of LVDT.
5. To determine the Characteristics of Thermistors and RTD.
6. Measurement of temperature by Thermocouples.
7. Design a regulated power supply of given rating (5 V or 9V).
8. To design and study the Sample and Hold Circuit.
9. To plot the frequency response of a microphone.

Suggested Books

1. W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice Hall (2005).
2. David A. Bell, Electronic Instrumentation & Measurements, Prentice Hall (2013)
3. S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mcgraw Hill (1998).
4. Basic Electronics:A text lab manual, P.B.Zbar, A.P.Malvino, M.A.Miller, 1990,Mc-Graw Hill

CBCS Syllabus for B.Sc. with Electronics

SKILL ENHANCEMENT COURSE PAPERS

four papers (02 credits each)

SEMESTER	III	TYPE	SEC (THEORY)	CODE	ELSSSEC01M	CREDITS	02
NAME	Design and Fabrication of Printed Circuit Boards					LECTURES	30

Unit 1 **Lectures 9**

- PCB Fundamentals: PCB Advantages, components of PCB, Electronic components, Microprocessors and Microcontrollers, IC's, Surface Mount Devices (SMD).
- Classification of PCB - single, double, multilayer and flexible boards, Manufacturing of PCB, PCB standards.

Unit 2 **Lectures 9**

- Schematic & Layout Design: Schematic diagram, General, Mechanical and Electrical design considerations, Placing and Mounting of components, Conductor spacing, routing guidelines, heat sinks and package density, Net list, creating components for library, Tracks, Pads, Vias, power plane, grounding.

Unit 3 **Lectures 9**

- Technology OF PCB: Design automation, Design Rule Checking; Exporting Drill and Gerber Files; Drills; Footprints and Libraries Adding and Editing Pins, copper clad laminates materials of copper clad laminates, properties of laminates (electrical & physical), types of laminates, soldering techniques. Film master preparation, Image transfer, photo printing, Screen Printing, Plating techniques etching techniques, Mechanical Machining operations, Lead cutting and Soldering Techniques, Testing and quality controls..

Unit 4 **Lectures 3**

- PCB Technology: Trends, Environmental concerns in PCB industry.

Suggested Books

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

SEMESTER	IV	TYPE	SEC (THEORY)	CODE	ELSSSEC02M	CREDITS	02
NAME	Robotics					LECTURES	30

Unit 1 **Lectures 8**

- Programming Environments: Integrated Development Environment (IDE) for AVR microcontrollers, free IDEs like AVR Studio, WIN AVR. Installing and configuring for Robot programming, In System Programmer (ISP), loading programmes on Robot

Unit 2 **Lectures 7**

- Actuators: DC Motors, Gearing and Efficiency, Servo Motors, Stepper motors, Motor Control and its implementations Sensors: White line sensors , IR range sensor of different range, Analog IR proximity sensors , Analog directional light intensity sensors , Position encoders , Servo mounted sensor pod/ Camera Pod, Wireless colour camera , Ultrasound scanner , Gyroscope and Accelerometer , Magnetometer, GPS receiver, Battery voltage sensing, Current Sensing

Unit 3 **Lectures 8**

- LCD interfacing with the robot (2 x 16 Characters LCD)Other indicators: Indicator LEDs, Buzzer
- Timer / Counter operations: PWM generation, Motor velocity control, Servo control, velocity calculation and motor position Control, event scheduling
- Communication: Wired RS232 (serial) Communication, Wireless ZigBee Communication, USB Communication, Simplex infrared Communication (IR remote to robot)

Unit 4 **Lectures 7**

- Interfacing to PIC16F887: LED, Switches, Solid State Relay, Seven Segment Display, 16x2 LCD display, 4x4 Matrix Keyboard, Digital to Analog Converter, Stepper Motor and DC Motor. Interfacing program examples using C language.

Suggested Books

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