ST. JOSEPH'S COLLEGE (AUTONOMOUS)

BENGALURU-27

Re-accredited with **'A++' GRADE with 3.79/4 CGPA** by
NAAC Recognized by UGC as College of Excellence

DEPARTMENT OF ELECTRONICS

Curriculum for B.Sc.

as per

NEP- 2020

SYLLABUS FOR I and II semester UNDERGRADUATE PROGRAMME

2021-2022 Onwards

Curriculum Structure

Semester	Title	
	Major: Discipline Core	**OE/DSE**
I Semester	DSC 1: Basic Electronics	OE1.1 Introductory Digital Concepts OE1.2 General Electricals DSE1: Wave Shaping Circuits
II Semester	DSC 2: Amplifiers, Oscillators and op Amps	OE2.1 Advanced Digital Electronics OE2.2 Home Appliances Servicing and Repair DSE2: Lab Equipments maintenance and servicing
III Semester	DSC 3: Digital Electronics and Verilog HDL	OE3.1 Computer Fundamentals OE3.2 Basic Computer Networks DSE3: Optical and Nanoelectronic Devices
IV Semester	DSC 4: Data Acquisition and Instrumentation (sensors)	OE4.1 Mobile Communication OE4.2 Renewable Energy and management DSE4: Audio Electronics
V Semester	DSC 5: Communication Electronics – I DSC 6: Microprocessors	DSE5.1: IC Fabrication and PCB Design DSE5.2: Information Technology Essentials (Anyone)
VI Semester	DSC 7: Communication Electronics– II DSC 8: 8051 Microcontroller	DSE 6.1: IoT and its Applications DSE 6.2: Computer Networking (Anyone)
VII Semester	DSC 9: Signals and Systems DSC 10: VLSI designing DSC 11: PIC Microcontroller and Embedded Systems	DSE 7.1: Aurdino/ Raspberry Pi DSE 7.2: Image and Signal Processing (Anyone) Research Methodology
VIII Semester	DSC 12: Digital Signal Processing DSC 13: Design of Analog Circuits/Design of Digital Circuits DSC 14: Robotics and Smart Homes	DSE 8.1: ARM Processor DSE 8.2: Advanced Computer Network DSE 8.3: Artificial Intelligence (Any One) Research Project

DSC: Discipline Core (Major)

OE: Open Elective (Open for all the streams)

DSE: Discipline Elective (Optional for I and II Semester)

Course Outcomes and Course Content

Semester	I
Paper Code	**DSC 1**
Paper Title	**Basic Electronics**
Number of teaching hours per week	04
Total number of teaching hours per semester	60
Number of credits	04

Objective of the Paper:

To make the students understand and learn the basic concepts of Electronics in detail which makes a firm basis for the advanced topics taught in higher semesters. The paper gives a detailed overview of network analysis, semiconductors, diodes, transistors number systems and Boolean Algebra which are the basic building blocks for understanding and designing electronic circuits.

Semester- I

ELE-DSC 1: BASIC ELECTRONICS

Unit 1 **20 Hours**

Electronic Components: Electronic passive and active components, types and their properties, Concept of Voltage and Current Sources, electric energy and power. (Qualitative only). Ohms law and Kirchhoff's law, Voltage Divider Rule and Current Divider Rule, Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer, and Reciprocity Theorems. DC and AC analysis of RC and RL circuits, RLC series and parallel Resonant Circuits (no derivation).

PN junction diode: Ideal and practical diodes, Formation of Depletion Layer, Diode Equation and I-V characteristics. Idea of static and dynamic resistance, Zener diode, Reverse saturation current, Zener and avalanche breakdown. Rectifiers-Half wave and Full wave (center tapped and bridge) rectifiers, expressions for output voltage, ripple factor and efficiency (mention only), Shunt capacitor filter. (Numerical examples wherever applicable).

Special semiconductor diodes: Varactor diode, Schottky diode, Tunnel diode, - construction, characteristics, working, symbol, and applications for each. LED, LCD and solar cell – construction, operation and applications, 7-segment display, concept of common anode and common cathode types. (Numerical problems wherever applicable).

Unit 2 **15 Hours**

Voltage regulator: Block diagram of regulated power supply, Line and Load regulation, Zener diode as voltage regulator – circuit diagram, load and line regulation, disadvantages. Clippers (shunt type) and clampers (Qualitative analysis only), Voltage Multipliers.

Bipolar Junction Transistor: Construction, types, CE, CB and CC configurations (mention only), V-I characteristics of a transistor in CE mode, Regions of operation (active, cut off and saturation), leakage currents (mention only), Current gains α , β and their inter-relations, dc load line and Q point. Applications of transistor as amplifier and switch - circuit and working. (Numerical examples wherever applicable).

UNIT 3 **10 Hours**

Transistor biasing : Thermal runaway, stability and stability factor, Stabilization circuits- Fixed Bias and Voltage Divider Bias. Amplifier: Small signal analysis of single stage CE amplifier using re' model. Input and Output impedances, Current and Voltage gains. Advantages of CC amplifier. (Numerical problems wherever applicable).

Unit 4 **15 Hours**

Number System: Decimal, Binary, Octal and Hexadecimal number systems, base conversions. Representation of signed and unsigned numbers, Binary arithmetic; addition, 1's complement and subtraction by 2's complement method, BCD code, Excess-3, Gray code, error checking and correction codes (Only parity check).

Boolean Algebra: Constants, variables, operators, basic logic gates-AND, OR, NOT, Positive and negative logic, Boolean laws, Duality Theorem, De Morgan's Theorem, simplification of Boolean expressions-SOP and POS. Derived logic gates (NAND, NOR, XOR & XNOR). Universal property of NOR and NAND gates. (Numerical examples wherever applicable).

Course Outcomes

At the end of this course, students will be able to

- Study and analyze basic networks using network theorems in a systematic manner.
- Build simple electronic circuits used in various applications.
- Describe the behaviour of basic semiconductor devices
- Reproduce the I-V characteristics of diode/BJT devices
- Describe the frequency response of BJT amplifiers.
- Explain the behaviour, characteristics and applications of Varactor diode, Schottky diode, Tunnel diode, LED, LCD and solar cells.
- Apply standard device models to explain/calculate critical internal parameters of semiconductor devices.
- Understand and represent numbers in powers of base and converting one from the other, carry out simple arithmetic operations.
- Understand the basic knowledge of Digital system building blocks, effectively can construct simple digital designs with the knowledge of Boolean algebra.

Reference Books:

1. Robert L Boylestad, “Introductory circuit analysis”, 5th edition., Universal Book 2003.
2. R.S.Sedha, “A Text book of Applied Electronics”, 7th edition., S. Chand and Company Ltd. 2011
3. A.P. Malvino, “Principles of Electronics”, 7th edition .TMH, 2011.
4. Electronic devices and circuit theory by Boylestad, Robert Nashelsky
5. David A. Bell “ Electronic Devices and Circuits”, 5th Edition, Oxford Uni. Press, 2015
6. Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia (1994)
7. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011, Tata McGraw
8. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
9. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
10. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning.
11. M. Nahvi& J. Edminister, “Electrical Circuits”, Schaum’s Outline SeriesTMGH2005
12. S. A. Nasar,” Electrical Circuits”, Schaum’s outline series, Tata McGraw Hill, 2004
13. J. Millman and C. C. Halkias, “Integrated Electronics”, Tata McGraw Hill, 2001
14. A.S. Sedra, K.C. Smith, A.N. Chandorkar “Microelectronic circuits”, 6th Edn., Oxford University Press, 2014
15. J. J. Cathey, “2000 Solved Problems in Electronics”, Schaum’s outline Series, TMG1991

Practical I

EL 1P1: Practical **(11 sessions 4 hours/week)**

List of experiments

Study of resistance color code, soldering practice, test and measuring instruments and Ohm’s Laws (1 practical class)

1.Charging and discharging of capacitor
2. Superposition Theorem
3. Thevenin’s Theorem
4. Maximum Power Transfer Theorem
5. Semiconductor diode and Zener diode characteristics
6. Center tap full wave rectifier with and without capacitor filter
7. Voltage tripler using diodes
8. Zener regulator- Line and Load regulation
9. Fixed bias circuit with emitter resistor
10. Voltage divider bias circuit
11. CE amplifier- Frequency response
12. Verification of truth tables of OR, AND, NOT, NAND, NOR, XOR and XNOR gates using respective ICs. Realization of XOR and XNOR using basic gates.
13. Universal property of NAND and NOR gates.
14. Binary to Gray and Gray to Binary code conversion and parity checker using XOR gates IC 7486.

ELE-OE1.1 INTRODUCTORY DIGITAL CONCEPTS

Unit I Introduction **05 Hours**

Digital and Analog Quantities, Digital waveforms, Binary Digits, Logic Levels and Digital Waveforms. Basic Logic Functions. Combinational and Sequential Logic Functions. Introduction to Programmable Logic. Fixed-Function Logic Devices. Positive and negative logic. Pulse characteristics.

Unit II Number Systems, Operations and Codes **20 Hours**

Decimal Numbers, Binary Numbers, Radix Representation of Numbers, Decimal to Binary Interconversion, Binary Arithmetic, Complements of Binary Numbers, Signed Numbers, Arithmetic Operations with signed Numbers, Octal Numbers, Hexadecimal Numbers. Codes: 8421, BCD, Excess-3, Gray, Alphanumeric, Bar code, QR code

Unit III Logic Gates **20Hours**

The Inverter, The AND gate, The OR gate, The NAND gate, The NOR gate, The Exclusive-OR and Ex-NOR gate, Programmable Logic and Fixed-Function Logic gates. Logic families-mention only.

Boolean Algebra and Logic Simplification: Boolean Operations and Expressions, Laws and Rules of Boolean Algebra. De Morgan's Theorems. Boolean Analysis of Logic Circuits. Logic Simplification using Boolean Expressions.

Books Recommended:

1. Digital fundamentals: T.L.Floyd , Universal Book Stall,8th edition,2005.
2. Modern digital electronics R.P Jain –TMH publication, 3rd edition, 2003.

Reference books:

1. Fundamentals of digital circuits: A Anand Kumar, PHI, 3rd edition 2004
2. Experiments in Digital Electronics: Malvino and Leach – TMH, 2000

3. Digital Lab Primer- K A Krishnamurthy, Pearson education 2003

Prerequisites: *The course is open for students of all the streams. No special prerequisite is required for this course other than interest in learning Binary and other number systems, Boolean algebra and Logic Gates which form the basis of any Electronic circuit and is fun to learn. The course develops a hobby in Electronics.*

ELE- OE1.2 General Electricals

Unit 1 Introduction **05 Hours**

Alternating current (AC) and Direct current (DC), graphical and symbolic representation of AC and DC. AC parameters, peak value, peak to peak value, rms value, period, frequency of voltage and current. Power, power rating. Non sinusoidal waveforms.

Unit 2 Sources of Energy and measurement **15Hours**

Sources of electric energy - cell; types, Batteries - rechargeable batteries, working principle. AC generation, AC generator- Single phase and poly phase system- salient and non salient pole generator, power formula, single line representation of power system, power distribution system.

Voltage, Current, Resistance, Capacitance, Inductance, Electrical conductors and Insulators, Ohm's law, Series and parallel combinations of resistors, Galvanometer, Ammeter, Voltmeter, Multimeter, Transformers, Electrical energy, Power, Kilowatt hour (KWh), consumption of electrical power.

Unit 3 Wiring Concept and Electrical devices **25Hours**

Single phase and three phase connections, Basics of House wiring phase neutral and earthing (colour codes), need for earthing- fuse and plugs-wiring fundamentals- typical wiring diagram-construction of extension board., Star and delta connection, Protective circuits: Electric shock, First aid for electric shock, Overloading Earthing and its necessity, Short circuiting, Lightening conductor , MCB , ELCB, Insulation, Inverter, UPS.

Principles of working, parts and servicing of Electric fan, Electric Iron box, Water heater; Induction heater, Microwave oven; Refrigerator, Concept of illumination, Electric bulbs, CFL, LED lights, Energy efficiency in electrical appliances, IS codes & IE codes. Switches and its types

Applications of electricity -lighting (incandescent bulb, LED and fluorescent lamp), heating and induction motors-working.

Books Recommended:

Prerequisites: *Basic knowledge of Electricity and Magnetism.*

ELE- DSE1: WAVE SHAPING CIRCUITS

UNIT I **10 Hours**

Linear wave shaping: Pulse Characteristics, Rise time, Fall Time, Ideal Pulse, High pass, low pass, RC circuits, their response for sinusoidal, step, Pulse, square and ramp inputs. RC network as differentiator and integrator circuit.

UNIT II **17 Hours**

Non – Linear Wave Shaping: Diode clippers: Series & Shunt, Emitter coupled clipper, Transfer characteristics of clippers, Comparators, clamping operation, Positive & Negative clampers, biased clampers, Clamping circuit theorem, Transfer characteristics of clampers.

Switching Characteristics of Devices: Diode and Transistor as switches, transistor-switching times break down voltage consideration of transistor, Design of transistor switch.

Unit III **10 Hours**

Analysis & design of Monostable, Astable Multivibrator: Analysis and design of Monostable multivibrators and Astable multivibrator using transistors.

Time Base Generators: General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators, Current time base generators.

Unit IV **08 Hours**

Synchronization and Frequency Division: Principles of Synchronization, Frequency division in sweep circuit, Synchronization of a sweep circuit with symmetrical signals, Sine wave frequency division with a sweep circuit.

Recommended Books:

1. Jacob Millman, Herbert Taub, Mothiki S. Prakash Rao (2008), Pulse, Digital and Switching Waveforms, 3rd edition, Tata McGraw Hill, New Delhi.
2. Solid state pulse circuits---David A Bell,4 th ed.2002.PHI

Reference Books:

1. David A. Bell (2002), Solid state pulse circuits, 4th edition, Prentice Hall of India, New Delhi, India.
2. Anand Kumar (2005), Pulse and Digital Circuits, Prentice Hall of India, India.
3. Mothiki S. Prakash Rao (2006), Pulse and Digital Circuits, Tata McGraw Hill, India

Course Outcomes and Course Content

Semester	II
Paper Code	**DSC-2**
Paper Title	**Amplifiers, Oscillators and Op-Amps**
Number of teaching hours per week	04
Total number of teaching hours per semester	60
Number of credits	04

Objective of the Paper:

To familiarize the students with the analysis and design of transistor amplifier circuits, operational amplifier circuits, oscillators, wave shaping circuits and design of regulated power supplies. Exposure of amplifiers, oscillators, op-amps and their main applications. Develop ability in students to apply knowledge and skills they acquire to find the solution of specific problems in electronics and build complete system using analog circuits.

Semester- II

ELE-DSC 2: Amplifiers, Oscillators and Op-Amps

UNIT 1: Amplifiers **18 Hours**

Multistage Amplifiers: Need & use of multistage amplifiers, overall gain, cascade vs cascode. RC coupled amplifier. Darlington amplifier – circuit, current gain, Zi, Zo, advantages.
Power amplifiers: Voltage Vs Power amplifiers, need for power amplifiers,
Classification Class A, Class C (mention only)
Class B: push pull amplifier, working, efficiency (derivation), cross over distortion, harmonic distortion, complimentary symmetry (transformer less). Comparison.
Tuned amplifiers: need for single tuned and double tuned, working, frequency response curve, advantages & disadvantages, note on coupling.

JFET–Types - p-channel and n-channel, working and I-V characteristics - n-channel JFET, parameters and their relationships, Comparison of BJT and JFET. CS Amplifier, MOSFET: E&D, MOSFET – n-channel and p-channel, Construction, working, symbols, biasing, drain and transfer characteristics, CMOS logic, CMOS – inverter, circuit and working, CMOS characteristics,

UNIT 2: FEEDBACK AMPLIFIERS AND OSCILLATORS **12 Hours**
Feedback: Types of Feedback Positive and Negative, Block Diagrams, Effect of Feedback on Av, BW, Zi, and Zo (only for Voltage Series Feedback Amplifier Circuit).

Need for oscillators; positive feedback, Tank circuit – oscillations, resonant frequency. Barkhausean criterion for oscillation, LC tuned oscillator - Colpitts and Hartley oscillator, frequency of oscillation (derivation), minimum gain, advantages & disadvantages, RC

Oscillators - phase shift & Wein bridge oscillator, frequency and minimum gain, crystal oscillator, piezoelectric effect, equivalent circuit, series & parallel resonant circuits, Q factor.
Non Sinusoidal oscillators: Astable Multivibrator, Working waveforms, frequency formula (mention only), Monostable multivibrator, bistable multivibrator (flip flop concept).

Unit 3: Integrated circuits **06 Hours**

IC555 block diagram & pin diagram. IC555 Application – Astable, Monostable (derivation), Voltage controlled oscillator. Schmitt trigger. IC Regulators: LM317, IC78XX, 79XX series (block diagram)

UNIT 4: OP. Amp. Theory and Applications **24 Hours**

Differential amplifier : Circuit configurations – working, dc & ac analysis of dual input balanced output differential amplifier – Av, Ri & Ro, Common mode gain, CMRR, current mirror – circuit & working differential amplifier with current mirror.

Op Amp block diagram, pin diagram IC741, specifications, characteristics of ideal and practical op amp parameters-input bias current, input offset voltage, output offset voltage, CMRR, slew rate SVRR, offset null, open loop op amp. limitations, Closed loop op. amp. Block Diagram of negative series feedback amplifier, Inverting and non-inverting feedback circuit-negative gain, Rif, Rof, Virtual ground, unity gain bandwidth.

Applications: Adder inverting and non-inverting, subtractor, scale changer, buffer, integrator, differentiator (ideal and practical). Comparator, zero crossing detector, Active filters-Butterworth first order low pass, high pass, band pass, band stop, all pass filters. Second order Filters (mention only).

Recommended Text Books
1, Operational amplifier and linear circuits, Ramakanth Gayakwad PHI, 5th Edition, 2015.
2. A Text Book of Applied Electronics, R.S. Sedha

Reference Books
1. Electronic Devices and circuits, T.F. Bogart and Beasley, Pearson Education, 6th Edition, 2004.
2. Electronics Principle-AP Malvino, Tata McGraw-Hill, 6th edition, 2005.
3. Electronic Devices and Circuits, T. L. Floyd, PHI, 5ht Edition 2005.
4. Micro electronics Circuits, Sedra and Smith, 5th Edition, Oxford University Press
5. Basic Electronics- A Text Lab Manual, Paul B Zbar, A.P. Malvino, TMH, 7th Edition,1995.

Practical II

EL2P1: PRACTICALS **(11 sessions 4 hours/week)**

List of experiments

1. Colpitts Oscillator
2. Construction of regulated power supply using IC 7805 and IC 7905
3. Op-amp Adder, subtractor and scale changer
4. Phase-shift oscillator using IC 741
5. Wien-Bridge oscillator using IC 741
6. Op-amp comparator
7. Hartley Oscillator
8. Astable multivibrator using transistors
9. Current and voltage regulation using IC LM 317
10 Op – amp as inverting and non-inverting amplifier.
11 Crystal oscillator
12. Astable multivibrator using IC555.
13. Tuned amplifier.
14. FET CS amplifier

Course Outcomes

CO1	Understand and analyze different types of amplifiers and oscillators.
CO2	Understand feedback techniques and its advantage and ability to design amplifiers.
CO3	Knowledge of the concepts of feedback and construct feedback amplifiers and oscillators.
CO4	Explain and compare the working of multi vibrators using special application IC 555
CO5	Design application oriented circuits using Op-amp and 555 timer ICs.
CO6	Design of fixed voltage regulators and frequency filters.
CO7	Skill to build and troubleshoot complete analog circuit.

ELE- OE2.1: Advanced Digital Electronics

Unit 1: Introduction to Digital Electronics and Combinational Logic Circuits 20 Hours

Introduction to Digital Electronics: Number Systems. Digital Electronic Signals and Switches, Basic Logic Gates AND, OR, and NOT, Universal Logic Gates NAND and NOR
Boolean Algebra and Reduction Techniques. Boolean Algebra, De Morgan's Theorem Exclusive OR and Exclusive-NOR gates, Arithmetic Operations. Simplification of logic circuits and vice versa, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Introduction to Multiplexers and Demultiplexers, encoders and decoder, BCD to 7 segment decoder

Unit 2 Logic Design and Sequential Logic Circuits 18 Hours

Logic Families and Their Characteristics, Flip-Flops: S-R Flip-Flop, D Flip-Flop, J-K Flip-Flop and Registers: Shift Registers. Serial/Parallel Data Conversions.
Sequential Logic, Counter Circuits. Asynchronous Counters, Synchronous Counter, Ripple counter, ADC and DAC converters.

Unit 3 Data Storage 07 Hours

Semiconductor Memory Basics, The Random-Access Memory (RAM), The Read Only Memory (ROM), Programmable ROMs and its types. The Flash Memory. Memory card, External hard disc, SSD- concept. PLA mention only.

Books Recommended:

1. Digital fundamentals: T.L.Floyd , Universal Book Stall,8th edition,2005.
2. Modern digital electronics R.P Jain –TMH publication, 3rd edition, 2003.

Reference books:

1. Fundamentals of digital circuits: A Anand Kumar, PHI, 3rd edition 2004
2. Experiments in Digital Electronics: Malvino and Leach – TMH, 2000
3. Digital Lab Primer- K A Krishnamurthy, Pearson education 2003

Prerequisites:

1. Basics of Digital Electronics like number system and logic gates.
2. *Willingness and desire to learn about Digital Circuits and their applications in modern day technology.*

ELE- OE2.2: Home Appliances Servicing and Repair

Unit 1: Electronic Equipments and Servicing **15 Hours**

Introduction–Passive components–Transformer–Working principle– application–Active devices: Diode–Transistor– Analog IC–amplifier– oscillators and Digital ICs

Soldering Iron–Flux–lead–Zero defect soldering– Desoldering pump– soldering station–Basics of Multimeter–Measurement of current, voltage and resistance using multimeter–Checking transistors and diodes–In circuit measurements.

Unit 2: Heating and Motorised appliances **20 Hours**

Heater types–working principle– Heating Rod–Iron Box–Iron box with steamer–Toasters– Geysers– Microwave Ovens– Oven –Disassembling and assembling procedure– Fault indicator–Testing and Troubleshooting methods.

Types of Motors–DC and AC motor– Fans– mixers– blenders–wet grinders– circuit connection-testing methods. Washing machine – Electrical connections–assembly – Dish washer –Electrical connection–Testing and troubleshooting methods.

Unit 3: Refrigeration Appliances **10 Hours**

Fridge– Electrical connection– Compressor–coolants–Automatic defrost circuits –Testing and troubleshooting of refrigerators–Air coolers and Air conditioners–Mounting and fixing of Air Conditioners–testing and troubleshooting methods.

Recommended Books:

1. Electronic instruments and systems: Principles, maintenance and troubleshooting by R. G. Gupta Tata McGraw Hill
2. Modern electronic equipment: Troubleshooting, repair and maintenance by Khandpur, Tata McGraw Hill
3. Electronic fault diagnosis by G. C. Loveday, A. H. Wheeler publishing

Prerequisites:

1. Basic knowledge of passive and active components of Electronics
2. Basic knowledge of Electricity and Magnetism.
3. Desire to learn the working mechanism behind the appliances used at home on day to day basis.
4. Interest to explore the electrical equipments and repair them on one's own.

ELE- DSE2 Lab Equipments Maintenance and Servicing

UNITI Basic Concepts **10 Hours**

Resistors–types–Colourcode–wattage–tolerance–capacitors–types–inductors–transformer–stepup and step down–uses–Diode–ratings– operation–transistor–NPN and PNP–switching–amplifier, Differential Amplifier Concepts–Diode and Transistor testing–MOSFET–Types– D and E types-Testing MOSFET, CMOS(Mention Only).

Attenuators and types, Probes, Wiring Pattern used, Connectors, PCBs, ICs,

UNITII Power supply **12 Hours**

AC power supply-parameters–DC power supply design–Regulated power supplies–single–Dual–variable voltage–Switched mode power supply– Transformerless power supply design– Design of fuses–Testing and troubleshooting.

UNITIII Analog Equipments **15 Hours**

Variable Resistance Box–Variable Capacitance Box– variable inductance box– Cathode Ray oscilloscope –Block diagram–Frequency measurement – Function generator– Range of frequencies–Amplitude–types of waveMeters- Ammeter-Voltmeter-CRO, Types of Oscilloscopes, Storage Oscilloscope- Testing and trouble shooting.

UNITIV Digital Equipments **08 Hours**

LED, Displays–current limiting concept–switches–types-Logic module–circuit diagram–Concept of common ground–Pulse generator–Circuit diagram – Active low and Active high pulses – Logic modules, interfacing boards– Kits–Testing and troubleshooting methods.

Recommended Books:

1. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance by Khandpur, TMH 2006.
2. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting by R. G. Gupta Tata McGraw Hill Edition 2001
3. Student Reference Manual for Electronic Instrumentation Laboratories by Stanley Wolf, and Richard F. M. Smith, Prentice Hall of India Pvt. Ltd. New Delhi
4 .Consumer Electronics by S. P. Bali, Pearson
5. Opamps - Design, Application and Troubleshooting by David L Terrell, Butterworth Heinemann
6. Electronic Testing and Fault Diagnosis by G. C. Loveday, A. H. Wheeler Publishing

Question Paper Pattern

Exam duration: 3hrs
Total marks : 100

Part A	MCQ (Answer all the following)	1*20 = 20
Part B	Descriptive (Answer any 5 out of 7)	12*5 = 60
Part C	Numerical (Answer any 5 out of 7)	4*5 = 20
	Total	100

*Note: 100 will be converted to 60