THE NATIONAL COLLEGE

AUTONOMOUS

Jayanagar, Bengaluru-70

DEPARTMENT OF ELECTRONICS

I Semester B.Sc ELE 101: Basic Electronics	
Total Teaching Hours : 54	No. Of Lecture Hours/Week:4
Max Marks:70	
About The Course	
ELE 101 is designed to serve as a first course in an undergraduate B.Sc Electronics curriculum. This course introduces students to network analysis and the basic components of electronics: diodes, transistors. It covers the basic operation and some common applications.	
Course Objectives	
After successfully studying ELE 101, students will be able to 1. To develop an ability to analyze linear circuits. 2. To develop an understanding of the PN junction diode and its behavior. 3. To develop an ability to analyze diode circuits. 4. To develop an understanding of the NPN BJT and its applications. 5. To develop an ability to analyze BJT circuits. 6. To develop an understanding of the BJT biasing circuits. 7. To Design BJT Biasing circuit. 8. To develop an understanding of the Small Signal amplifiers and their behavior. 9. To develops an understanding of the Large Signal amplifiers and their behavior	
Course Outcomes:	
At the end of this course student will: 1. Analyze circuits containing resistors and independent sources using techniques such as mesh current, Superposition and the Thevenin's methods.	

2. Analyze simple circuits made up of linear lumped elements, resistors, capacitors and inductors
3. Analyze circuits made up of pn junction diode and BJT
4. Perform a small-signal analysis of an amplifier using small signal models for the circuit elements.
5. Calculate the frequency response of circuits containing resistors, capacitors and inductors.
6. Construct simple, amplifiers, in the laboratory.
7. Determine in the laboratory the frequency-domain behavior of an RLC circuit.

UNIT I	Teaching Hours :12

NETWORK ANALYSIS (FOR DC RESISTIVE NETWORKS)

Current and Voltage Sources: Review of sources of electrical energy. Voltage source: Concept of voltage source, ideal voltage source, practical voltage source and constant (stiff) voltage source. Current source: Concept of current source, ideal current source, practical current source and constant (stiff) current source. Source conversion.

Basic Laws: Voltage divider rule, current divider rule (derivations),Kirchhoff's laws-statements and explanations.

Methods of Circuit Analysis: Mesh current method- Steps involved in the analysis of a circuit, Problems. Mention of Branch current and Node voltage methods.

Network Theorems: Superposition theorem –statement and explanation, steps to apply the theorem. Thevenin's theorem-statement and explanation, steps for Thevenising a circuit. Norton's theorem-statement and explanation, steps for Nortonising a circuit. Maximum power transfer theorem – statement and proof, expression for the maximum power delivered, graphical representation.

DC and AC Circuits: Transients- Charging and discharging of a Capacitor in a RC circuit (derivation of expressions), definition of time constant and graphical representations of charging and discharging periods

Review of AC Principles- instantaneous value, peak value, peak to peak value, average value and rms (effective) value, phase of an ac, phase difference, phase lead and lag. Reactance- inductive and capacitive reactance.

Transformer: Principle, construction, working and types

Resonance: AC applied to a series LCR circuit, Series resonance circuit, condition for resonance, expression for the resonance frequency, bandwidth, quality factor, effect of R,L and C on the resonance curve, sharpness of resonance, selectivity. Parallel resonance (qualitative analysis), comparison of series and parallel resonance.
Switches: SPST, SPDT, DPST and DPDT, fuse and electromagnetic relay.

UNIT II	Teaching Hours :10

SEMICONDUCTOR DIODE

pn junction: Review of p type and n type semiconductors. pn junction, formation of depletion region and potential barrier, barrier potential, energy level diagram. Biasing of pn junction –forward bias and reverse bias, knee voltage, reverse saturation current, break down mechanisms, reverse break down voltage.
Junction diode: Diode symbol, V-I characteristics (forward and reverse), bulk resistance, static and dynamic resistance and PIV of diode. Diode approximations, diode equation (no derivation).

Special Purpose Diodes: Zener diode: reverse Breakdown mechanisms, V-I Characteristics. Varactor diode- construction and working V-I characteristics, applications. LED - construction and working, LED Seven segment display-Common Anode and Common cathode Types.

UNIT II	Teaching Hours :10

DIODE CIRCUITS

Rectifiers and Filters: Block diagram of a power supply. Rectification, Half wave, Full wave and Bridge rectifiers –circuit diagram, working, expression for the output voltage in each case, ripple factor and rectification efficiency for half wave and full wave rectifiers, advantages, disadvantages and application of three types of rectifiers, comparison of three types of rectifiers.
Filters: Definition, need for filter, shunt capacitor filter, series inductor filter.
Clippers: positive, negative, biased and combination clippers (shunt type only).Clampers –Positive, negative and biased clampers.
Zener voltage regulator-Load and Line regulator.

UNIT IV	Teaching Hours :10

BIPOLAR JUNCTION TRANSISTOR

Bipolar Junction Transistor: npn and pnp transistors. Construction of **npn** and **pnp** transistors, Transistor symbols, normal biasing of EB and CB junctions. Working of npn and pnp transistors. Transistor configurations –CE, CB and CC. Transistor characteristics, CB characteristics, current gain , input impedance and output impedance. CE characteristics, current gain , input and output impedance, different regions of output characteristics –Active, cutoff and saturation regions. Relation between α and β . Leakage currents. Transistor as a switch.

Transistor Biasing: Need for biasing, DC load line, operating point. Types of biasing circuits –Fixed bias and Voltage divider bias.

UNIT V	Teaching Hours :12

TRANSISTOR AMPLIFIERS

Small Signal Amplifiers: Classification, characteristics of amplifiers. Small signal amplifiers- Single stage CE Amplifier- Construction and working with Voltage divider bias, analysis using r_e^1 model AC equivalent circuit, frequency response. Multistage Amplifiers- Types, Direct Coupled amplifier construction and working, frequency response. RC Coupled amplifier- construction and working, frequency response.

Power and Tuned Amplifiers: Classification**,** Single ended class A power amplifier- efficiency. Class B pushes Pull Power amplifier- construction, working and expression for efficiency, cross over distortion. Class C power amplifier.

Tuned Amplifiers: Need for Tuned amplifiers, Single and double tuned amplifiers- working and frequency response

Text Books

1. Introductory circuit analysis: Robert Boylestad –Pearson 12TH Edition
2. Electronic Devices: T.L Floyd, Pearson Education, 7TH Edition.
3. Basic Electronics and Linear circuits: Bhargava , kulashresta and Gupta ,TMH 2010

Reference Text Books:

1. Basic Electronics: B Grob and M E Schultz-TMH 9TH Edition.
2. Electronic principles: A.P.Malvino and D.J.Bates TMH 7TH Edition.
3. Electronic Devices and Circuit Theory: R.L.Boylestad and

L.Nashelesky,Pearson 10 TH Edition

I Semester B.Sc

ELE 102: Basic Electronics Lab

Max Marks:35	No. Of Lecture Hours/Week:3

About The Course

ELE 102 is designed to serve as a first course in an undergraduate B.Sc Electronics Laboratory curriculum.

PART A

(Demonstration experiments- not for evaluation)

1. Identification of Electronic components and their circuit symbols.
2. Familiarization of Electronic instruments: Digital Multimeter, DC Regulated Power Supply-fixed and variable, Function Generator and C.R.O.

PART B

(Performance Experiments)

(Any EIGHT Experiments)

1. Verification of Thevenin's theorem
2. Verification of Superposition theorem
3. Verification of Maximum power transfer theorem
4. Analysis of Series and Parallel Resonance
5. V-I Characteristics of a Semiconductor Diode and Half wave Rectifier.
6. Analysis of Full wave rectifier with and without shunt capacitor filter
7. Zener diode characteristics and Zener diode regulator
8. Transistor CE characteristics
9. Design of Voltage divider bias circuit
10. Frequency response of CE Amplifier

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II Semester B.Sc ELE 201: Digital Electronics	
Total Teaching Hours : 54	No. Of Lecture Hours/Week: 4
Max Marks:70	
About The Course	
ELE 201 is designed to serve as a second course in an undergraduate B.Sc Electronics curriculum. This course introduces students to basic principles of Digital Electronics.	
Course Objectives	
The objectives of the course ELE 201 1. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits. 2. To prepare students to perform the analysis and design of various digital electronic circuits.	
Course Outcomes	
After studying this course, the students would gain enough knowledge 1. To have a thorough understanding of the fundamental concepts and techniques used in digital electronics. 2. To understand and examine the structure of various number systems and its application in digital design. 3. To understand, analyze and design various combinational and sequential circuits. 4. To identify basic requirements for a design application and propose a cost effective solution. 5.To develop skills to build, and troubleshoot digital circuits	
UNIT I	Teaching Hours :10
NUMBER SYSTEM AND BINARY CODES	

Introduction : Analog and Digital signals/systems,

Number systems – Binary, Octal and Hexadecimal –Base or Radix, Positional weight, significance of binary, Octal and Hexadecimal numbers in digital systems,Bit, Nibble , Byte, Kilobyte, Mega byte, Giga byte and Tera bytes. Number system inter conversions

Arithmetic operations: Binary addition, Binary subtraction, Hexadecimal addition. Representation of positive and negative numbers in Binary –Sign magnitude and 1's and 2's complement representation,2's complement subtraction

Binary Codes: Introduction, types and examples.8421and 2421codes, applications. Gray code – Principal characteristic of Gray code, conversions – Binary to Gray and vice versa, significance of Gray code in A/D conversion and applications. Excess 3 code.

Alphanumeric codes- ASCII code and EBCDIC code – significance and applications.

UNIT II	Teaching Hours :12

LOGIC GATES AND BOOLEAN ALGEBRA

Logic gates: Positive and Negative logic –Meaning and Examples. Review of basic logic gates. NAND and NOR gate –Logic symbol, Truth table, Timing diagrams and realization of two input gate using Diodes and Transistors on each case.

Boolean algebra: Rules and Laws. Theorems- De Morgan's Theorems-

Statements, proof, Truth tables and logic circuits, Duality theorem. Simplification of Boolean expressions, examples. X-OR gate and X-NOR gates –Logic symbol, Truth table, realization using basic gates, applications, Timing diagrams. Universal property of NAND gate and NOR gates- Realization of NOT,OR,AND,X-OR and X-NOR gates using NAND and NOR gates.

Simplification of logic expressions using Boolean algebra. SOP and POS expressions, standard SOP and POS forms, conversion of Boolean expressions to standard SOP and POS forms.

Karnaugh Maps- K –map techniques to solve 3 and 4 variable expressions, conversions of Truth tables into K-Map, rolling of K-Maps, grouping of cells and redundant groups, don't care conditions. Implementation of simplified expressions using NAND and NOR Gate respectively

UNIT III	Teaching Hours :10

DIGITAL LOGIC FAMILIES

Pulse characteristics: Pulse characteristics- Ideal and Practical pulse, diagrammatic representation of input and output pulses, definition of Delay time, Rise time, Fall time. Classification of Digital IC's

Logic families : Bipolar transistor families-DTL,TTL and ECL. Standard TTL NAND Gate with Totem pole output – Circuit and operation. Characteristic of TTL-Floating Input, Current source and Current sink, TTL input and output profiles windows, Fan-in, Fan-out, noise immunity, operating temperature range, power supply requirements, Propagation delay and Power dissipation. Schottky TTL NAND gate – Circuit, operation and advantages. Comparison of propagation delay time and power dissipation for different TTL families. MOS logic families -PMOS, NMOS and CMOS.

UNIT IV	Teaching Hours :10

COMBINATIONAL LOGIC CIRCUITS

Arithmetic circuits : Half Adder – Logic symbol, truth table, Logic circuit.

Full Adder – Logic symbol, Truth table and Logic circuits. 4-Bit parallel Binary Adder –Schematic block diagram. Half Subtractor – Logic symbol, Truth table and Logic circuit . Magnitude comparator-2 Bit and 4 Bit comparators – Logic symbol, logic circuit and applications.

Encoder-Decimal to BCD Encoder- Logic symbol and Truth table, priority encoder. Decoder-BCD to Decimal decoder, Logic symbol and Truth table. BCD to Seven segment decoder driver- IC 7446 and IC 7447 – Logic diagrams of each IC – Pin functions, applications. Multiplexer – Logic symbol,4:1 and 8:1 Multiplexer – Logic circuit, Truth table and applications. De-Multiplexer – Logic symbol,1:4 and 1:8 De-Multiplexer – Logic circuits, Truth table and applications.

UNIT V	Teaching Hours :12

SEQUENTIAL LOGIC CIRCUITS

Flip Flops: Sequential Logic circuits – Introduction and importance of clock in digital circuits. Difference between latch and Flip-Flop.

RS Latch – Logic circuit using NAND gates, working and Truth table, Timing diagram-Logic circuit using NOR gates, working and Truth table. RS Flip Flop-Logic circuit, working, Truth table and Timing diagram. D Flip Flop – Logic symbol, logic circuit, working, Truth table and Timing diagram. JK Flip Flop – Logic symbol, Realization of edge triggered JK Flip Flop using NAND gates,

working, Truth table, Timing diagram, race around condition, preset and clear inputs. Master slave JK Flip Flop – Logic symbol, Logic circuit using Two JK Flip Flops, working, Truth table and Timing diagram, Significance of Master slave JK Flip Flop. T Flip Flop: Logic symbol, JK Flip Flop to T Flip Flop, working, Truth table and Timing diagram.

Shift Registers: Types, Logic diagram, operation in brief, truth table, Timing diagram in each case, speed comparison and applications.

Counters: Introduction to Counters – Principle, need, modulus of a counter. Classification- Synchronous and Asynchronous. Asynchronous 3 Bit Ripple Up Counter, 4 Bit Up- Down Counter – Logic diagram, Truth table, Timing diagram. Modified up counters (mod n): mod 3 and mod 5 counters – Logic diagram, Truth table, Timing diagram. Decade up counter- Logic diagram, Truth table and Timing diagram. Synchronous counters: Synchronous parallel Binary counter- Logic diagram, Truth table and Timing diagram. Synchronous counter design using K-maps – for mod -3,mod -5 and Decade counter. 4 Bit Johnson ring counter – Logic diagram, Truth table, Timing diagram and applications.

Memory devices: Introduction – Primary and Secondary memories.

RAM – Static and Dynamic. ROM, PROM, EPROM and EEPROM – Description, memory capacity, advantages, disadvantages and applications.. Secondary Memories: CD -Description, memory capacity, advantages, disadvantages and applications. Pen drive.

Text Books

1.Digital Principles and Applications : A.P Malvino,D. Leach and Shah
-TMH Edition.

2. Digital Fundamentals: T L Floyd- Pearson 10th Edition.

Reference Text Books:

1. Digital Logic: John. M. Yarbrough – Thomson learning 2001
2. Digital Systems: Principles and Applications: R. J Tocci and others

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II Semester B.Sc

ELE 202: Digital Electronics Lab

Max Marks:35	No. Of Hours/Week:3

About The Course

ELE 202 is designed to serve as a Second course in an undergraduate B.Sc Electronics Laboratory curriculum.

(Any EIGHT Experiments)

1. Realization of AND, OR, NOT, NAND and NOR gates using Diode and Transistor
2. Realization of AND, OR, NOT, NOR and X-OR gates using IC 7400 and IC 7402.
3. Study of Half Adder and Half Subtractor (using NAND Gates).
4. Study of Full Adder using IC 7486, 7408, 7432 and 7400.
5. Binary to Gray code conversion and Vice versa using IC 7486.
6. Study of Multiplexer using IC 74150. Study of De multiplexer using IC 75154.
7. Study of Encoder and Decoder
8. Study of RS and D Flip Flops.
9. Study of JK Flip Flop.
10. Study of 4 Bit Binary ripple up counter using IC 7476 (or equivalent) and conversion to decade counter

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THE NATIONAL COLLEGE

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JAYANAGAR, BENGALURU-70

DEPARTMENT OF ELECTRONICS

III SEMESTER B.Sc

ELE 301: Operational Amplifier and Special Semiconductor Devices

Total Teaching Hours : 54	No. Of Lecture Hours/Week:4
Max Marks:70	Credits :4

About The Course

ELE 301 is designed to serve as a third course in an undergraduate B.Sc Electronics curriculum. This course introduces students to basic principles of Operational Amplifiers and Special Semiconductor Devices.

Course Objective:

1. To acquire the basic knowledge of Operational Amplifiers and application of Operational Amplifiers
2. To acquire the basic knowledge of Special Semiconductor Devices.
3. To prepare students to perform the analysis and design of various Operational Amplifier and Special semiconductor Device circuits.

Course Outcome

1. Apply the knowledge of working principle of operational amplifier to arrive at suitable conclusions for a given analog electronic circuits
2. Analyze the given analog electronic circuit with a given specifications.
3. Conduct experiments to demonstrate the application of analog electronic circuits using op amp and other analog components.

UNIT I	**OPERATIONAL AMPLIFIERS (op-amps)**	Teaching Hours :10

Differential Amplifier-circuit, working, expression for voltage gain, input and output impedance. Common mode gain, differential mode gain. CMRR. Current mirror. Circuit of a differential amplifier with current mirror.

Operational Amplifier-Block diagram, equivalent circuit and pin configuration of IC 741.characteristics of ideal and practical op-amp. Parameters.

Op-amp configurations: Open loop op-amp configuration-Inverting Amplifier, Non-inverting amplifier and differential amplifier. Closed loop op amp configurations- Op-amp Non-inverting amplifier, Op-amp inverting amplifier -expression for the voltage gain, input and output impedances.

UNIT II	**APPLICATIONS OF OP-AMP**	Teaching Hours :12

Op-Amp adder – Inverting adder, averager, non-inverting adder, Scale changer, Op-Amp Subtractor ,Op-Amp Buffer -expressions for the output voltage. Op-Amp Differentiator. Op-Amp Integrator . Logarithmic amplifier. Antilogarithmic amplifier. Voltage Sensing using Op Amp.Active filters – comparison of active and passive filters, advantages of active filters. First order Butterworth low pass, high pass and band pass filter ,Band reject filter .All pass filter. Comparators.

Digital to Analog converters(DAC)-weighted resistor DAC, R-2R ladder network DAC. Analog to digital converters(ADC)- Successive approximation ADC.

Mention of special purpose op-amps –IC 723, IC 725 etc

UNIT III	**FEEDBACK AMPLIFIERS**	Teaching Hours :08

Feedback in Amplifiers-Concept of feedback, Types of feedback. Feedback topologies, expression for voltage gain with feedback. Advantages and disadvantages of Positive and negative feedback, Effect of negative feedback on 1) Stability, 2) Input impedance, 3) Output impedance, 4) Bandwidth, 5) Distortion and 6) Noise. Practical feedback amplifiers- Op- amp with negative feedback, Emitter follower, CE amplifier with negative feedback

UNIT IV	**OSCILLATORS AND MULTIVIBRATORS**	Teaching Hours :10

Oscillators- Damped and undamped oscillations, working of a LC tank circuit. Positive feedback amplifier as an oscillator. Barkhaussain criterion for sustained oscillation. Classification of oscillators-LC and RC oscillators.

LC oscillators: Hartley oscillator ,Colpitt's oscillator. Applications of LC oscillators. RC oscillators: Phase shift oscillator. Wein bridge oscillator. Applications of RC oscillators. Crystal oscillator.

Multivibrators - Types of multivibrators – Astable, Monostable and Bistable.**555 timer**-Astable multivibrator using 555 timer- Monostable multivibrator using 555 timer.

UNIT V	**SPECIAL SEMICONDUCTOR DEVICES**	Teaching Hours :12

Field Effect Transistor (FET)- Types of FET.**JFET**–construction, working, Characteristics and parameters. Common source amplifier-Expression for voltage gain, input and output impedances. Comparison of JFET and BJT.**MOSFET**-Depletion type MOSFET, Enhancement type MOSFET

Unijunction Transistor (UJT) - Construction, working and Characteristics. UJT relaxation oscillator –expression for the frequency of oscillations.

Special Power Electronic devices

Silicon controlled rectifier (SCR) – Construction, working and Characteristics. SCR rectifiers: half wave and full wave rectifiers – expression for V_{av}, I_{av}, P_{av}. Diac, Triac and SCS.

PowerMOSFET, IGBT.

Integrated Circuits – Introduction, advantages and disadvantages. Classification of IC– Monolithic and hybrid IC's. Linear and digital IC's. Constructional aspects of monolithic IC.

Text Books:	

TEXT BOOKS;

1. Electronic Devices
   - T.L.Floyd,Pearson Education, 9th Edition,2015

2. Operational Amplifiers and Linear Integrated Circuits
   -R.A. Gayekwad, PHI 5th Edition

Reference Text Books:

1. Electronic Principles
   - A.P Malvino, David.J Bates_ Macgraw Hill 7th Edition,2010
2. Electronic Devices and Circuit theory
   - Robert Boylestad, Louis Nashelsky ,Pearson 9th Edition, 2008
3. Basic Electronics and Linear circuits
   - N.N .Bhargava, D.C.Kulashresta and S.C Gupta, MacgrawHill,2012.
4. Power Electronics- Bimbra

III SEMESTER B.Sc

TITLE: Analog Electronics Lab

PAPER CODE: ELE 302	CREDITS : 1	NO OF HRS: 3hrs/week

1. CE amplifier with and without emitter feedback capacitor.
2. FET characteristics and Common Source amplifier
3. Op-amp Inverting and Non-inverting amplifier.
4. Op-Amp Adder and Subtractor.
5. Active Low pass and High pass filters using IC 741.
6. R-2R ladder network DAC.
7. SCR Characteristics
8. Wein Bridge Oscillator using IC741.
9. Astable and monostable multivibrator using IC 555.
10. UJT characteristics and Relaxation oscillator

IV SEMESTER B.Sc **ELE 401**: 8085 Microprocessor and Electronic Instrumentation	
Total Teaching Hours : **54**	No. Of Lecture Hours/Week:**4**
Max Marks:**70**	Credits :**4**

About The Course

ELE 401 is designed to serve as a fourth course in an undergraduate B.Sc Electronics curriculum. This course introduces students to microprocessors and Microcontroller.

Course Objective:

1. To acquire the basic knowledge of architecture of Microprocessor and programming
2. To acquire the basic knowledge of Electronic Instrumentation.
3. To acquire the basic knowledge of Bio medical Electronic Instrumentation

Course Outcome

1. Analyze the architectural features of 8085 microprocessor,
2. Apply the acquired knowledge on 8085 architecture, their features and instruction set in programming the 8085 microprocessor processor.
3. Analyze various electronics instruments and Bio medical electronic instruments

UNIT I	**Microprocessors**	Teaching Hours :08

Basic block diagram, speed, word size, classification of Microprocessors. Block diagram of a microprocessor based personal computer system.

8085 Microprocessor: Features, Architecture –Block diagram, internal registers, Register pairs, Flags, Stack pointer, Program counter, Types of Buses. Multiplexed Address and Data bus, Pin description of 8085.

UNIT II	**8085 Instruction Set and Programming**	Teaching Hours :14

Instruction set of 8085: Instruction format, Operation code, Operand. Comments and Labels Addressing modes, Instruction classification_Data transfer, Arithmetic, Logical, Branching and Machine control instructions. Illustration of these instructions with simple programs. Stack operations, Subroutines, calls and return

operations. Delay loops, use of counters, Instruction cycle, Machine cycle, T- states, Time delay-Numerical examples. Programs for Data transfer and Memory operations (direct & indirect addressing), Addition and Subtraction of two 8-bit & 16- bit numbers, Multiplication, Display of smallest / largest number in a given array of numbers, Sorting of numbers in descending / ascending order. Number of 1's and 0's in a given byte, testing for zero condition. 1's and 2's complements. Program to add n one byte numbers, Program to display decimal Up/Down counters.

UNIT III	Interrupts and Interfacing	Teaching Hours :08

Interrupts of 8085- Hardware and software interrupts, Interrupt service subroutine, maskable and non maskable interuupts, interrupt priority.

Basic interfacing concepts, Data transfer, Synchronous I/O data transfer using interrupts. Interfacings I/O devices- Memory mapped and standard I/O interfacing Input/ Output Ports, IN & OUT instructions.

PPI IC 8255—Features, Pin diagram, Functional block diagram, Ports, modes of operation of I/O ports.

UNIT IV	Measurement Systems	Teaching Hours :12

Introduction to General measurement system – characteristics - definition –static & dynamic. Errors – Systematic errors and their reduction, Random errors. Block diagram of data acquisition system. Signal transmission – Electrical, pneumatic and fiber optic transmissions, Radio telemetry.

Sensors and Transducers: Types – resistive, capacitive and inductive, Hall effect sensors, optical sensors Piezoresistive sensors. Strain gauge, LVDT, Variable inductive transducers, Temperature transducers- thermo couple, Thermistors, Ultrasonic transducer, Piezoelectric transducers, Pressure transducers. Signal conditioning

(concept only).
Amplifiers – chopper Amplifier –carrier amplifier - lock in Amplifier

UNIT V	**Introduction to Bio Medical Instrumentation**	Teaching Hours :12

Sources of Biomedical Signals, Origin of Bioelectric Signals, Resting & Action potential – propagation, physiological transducers – active & passive transducers for medical applications – diagnostic & Analytical equipments, Electrodes of biophysical sensing, microelectrodes, Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG), Electroretinogram (ERG), Recording Electrodes–Electrode-tissue interface, Electrolyte-Skin interface, polarization, skin contact impedance, motion artifacts, Silver-Silver Chloride electrodes, Electrodes for ECG, Electrodes for EEG, Electrodes of EMG, microelectrodes. Block diagram of ECG and EEG systems.

Text Books:

TEXT BOOKS:

1. Microprocessor Architecture, Programming and Applications with 8085.
   - Ramesh S. Gaonkar, Vth Edition, 2002, Prentice Hall.
2. Electronic Instrumentation
   - H. S. Kalsi, 2004, TMH.
3. Handbook of biomedical instrumentation.
   - Khandpur R S, TMH 2nd Edition, 2011.

Reference Text Books:

1. Introduction to Microprocessor.
   - Aditya P. Mathur**,** TMH 3rd Edition., 1995.
2. Digital Computer Electronics.
   - A.P Malvino TMH.
3. Electrical and Electronics measurement and Instrumentation.

- A.K.Sawhney, 11th Edition, Dhanapatrai and co.

4. Bio Medical Electronics.

-D.V.Kamat and Sudha Kamat,EDPB

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IV SEMESTER B.Sc

TITLE: 8085 microprocessor LAB

PAPER CODE: ELE402	CREDITS : 1	NO OF HRS: 3hrs/week

1. Program to add & subtract two 8-bit numbers (Binary and BCD).
2. Program to add & subtract two 16-bit numbers.
3. Program to multiply two 8-bit numbers.
4. Program to find the ratio (division) of two 8-bit numbers.
5. Program to find the number of 1's & 0's in a given byte.
6. Program to find the sum of n one byte numbers in an array.
7. Program to find the largest/smallest number in an array.
8. Program to sort the given array of numbers (Ascending/desending order).
9. Program to display decimal up counting (00-99).
10. Program to find the solution of the Equation y = mx+c.

THE NATIONAL COLLEGE
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JAYANAGARA, BENGALURU

Interdisciplinary Course in Electronics

III SEMESTER

PAPER IDEL301: Discover Electronics

Lecture Hrs: 2hrs per week **Total number of Hours: 24**

UNIT 1: Introduction to Electronics (08 hrs)

Electronics and its applications. Difference between Electrical and Electronic Devices. History of Electronics. Impact of electronics on Modern life. Types of Electronics Devices: Analog and Digital. Safety Precautions.

UNIT 2: Electronic components (08 hrs)

Resistors, Capacitors, inductors- types, uses. Conductors, insulators, semiconductors- definitions. Semiconductor materials- Silicon, Germanium, semiconductor devices: Diode, Transistor, IC's, PCB. Optoelectronics Devices: LED,LCD,OLED.

UNIT 3: Electronics Devices (08 hrs)

DC power supply. Amplifiers, Oscillators. Basics of measuring instruments- DMM and CRO. Medical electronic Instruments.

Books for Reference:

Principles of Electronics- V K Mehta and Rohit Mehta,
11th edition, 2008 S Chand and Co, New Delhi

IV SEMESTER

Interdisciplinary Course in Electronics

PAPER IDEL401: Electronic Gadgets

UNIT I: Fundamentals of Electronic Audio and Video Systems (08hrs)

Basic principle of electronic communication- Line and wireless, merits and demerits. Basic operation of transmitter and receivers. AM and FM radio receivers- qualitative description. Microphone, Loud speakers- basic working. Compact disc, DVDs. Principle of TV transmission and reception, Colour TV principle, Simplified block diagram of TV. Digital TV principle- set top converter box, Satellite TV- operating principle. Flat panel TV, projection system- qualitative description.

UNIT II: Telephone Communication Systems (08 hrs)

Wired telephone – basics of telephone, telephone exchange, cables- copper cable, Optical fiber cables- principle of operation, cordless phone- working, advantages and disadvantages. Fundamentals of cellular mobile phone- Cells, coverage area, roaming, operation (qualitative description). Latest trends in mobile phones, smart phones, generations. Satellite phone.

UNIT III: Basics of Computer Hardware (08 hrs)

Fundamentals of Digital computer, microprocessors, memory, motherboards, power supply, SMPS, floppy disc drive, hard disc drive, CD ROM /CD writer, mouse, keyboard, Modems, sound card, scanners, I/O Ports and devices, monitors, printers, latest trends in computers, specifications.

Books for Reference:

1. Principles of Electronics -V K Mehta and Rohit Mehta “”, S Chand and Co, New Delhi 11th Edition 2011.
2. Communication Electronics- Louis.E Frenzel- 3rd Edition

THE NATIONAL COLLEGE

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Jayanagar, Bengaluru-70

DEPARTMENT OF ELECTRONICS

V Semester B.Sc **PAPER: 5SELE5T: MICROCONTROLLERS AND PROGRAMMING**	
Total Teaching Hours : 45	No. Of Lecture Hours/Week:3
Max Marks:70	

About The Course

5SELE5T is designed to serve as a fifth course in an undergraduate B.Sc Electronics curriculum. This course introduces students to architecture and programming of 8051 microcontroller and interfacing.

Course Objectives

The objectives of the course 5SELE5T

1. To gain an in-depth understanding of the operation of 8051 microcontrollers,
2. To learn assembly language and c programming of 8051microcontroller
3. To learn interfacing techniques with peripheral devices
4. To gain an understanding of applications of microcontroller in designing automated electronics system.

Course Outcomes

After studying this course, the students would gain enough knowledge

1. of the general architecture of microcontrollers.
2. of the architecture of 8051 microcontroller
3. to program 8051 microcontroller.
4. to understand basics of interfacing of 8051.
5. to design microcontrollers-based systems.

UNIT I	Teaching Hours :12

Introduction to Microcontrollers

Introduction to Microcontrollers– Comparison of Microcontroller and Microprocessors, Basic block diagram, Comparison of 8 bit, 16 bit and 32 bit microcontrollers. RISC and CISC processors, Von-

Neumann and Harvard CPU architectures,

Overview of 8051 series–Comparison of 8031, 8051 and 8052.

Other Microcontroller families (Overview)– Maxim 89C420, 89C440, 89C450.

Atmel Corporation AT89C51, AT 89LV51, AT89C1051, AT89C2051, AT89C52.

8051 Microcontroller - Architecture, Internal block diagram, Key features of 8051, Pin diagram, CPU of 8051,Memory organization, Internal RAM memory, Internal ROM, General purpose data memory, special function/purpose registers(SFR), External memory., Program Counter, DPTR, Flags and PSW. 8051 oscillator and clock. Stack and stack pointer.

UNIT II	Teaching Hours :12

8051 Instruction Set

Addressing modes–Immediate addressing, Register addressing, Direct addressing , Indirect addressing and Base register plus Index register indirect addressing.

Data transfer instructions – Internal data move, external data move, code memory read-only data move, Push and Pop and data exchange instructions.

Logical Instructions – Byte level logical operations, Bit level logical operations, Rotate and Swap operations.

Arithmetic Instructions – Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal arithmetic, Simple Programs in Assembly language

Jump and Call instructions – Jump and Call program range, Jumps, Calls and Subroutines, Interrupts and Returns, Simple Example Programs using Assembly language

8051 programming using C: Data types and time delays in 8051C, I/O programming, logic operations, data conversion programs, accessing code ROM space and data serialization.

UNIT III	Teaching Hours :12

I/O Ports, Timer/Counter and Serial port

Input / Output ports and circuits/ configurations, I/O Port programming,

Timers and Counters – TCON and TMOD registers, Timer modes of operation. Programming 8051 Timers, Counter Programming, programming timers 0 and 1 in 8051 C.

Serial data input / Output – SCON, PCON, Serial data transmission modes. Programming 8051 serial port.

UNIT IV	Teaching Hours :09

Interrupts, Interfacing with 8051 and overview of PIC microcontrollers

8051 Interrupts – IE, IP registers, timer flag interrupts, serial port interrupt, external interrupts, Reset, Interrupt control, Interrupt priority, Interrupt destinations & Software generated interrupts interrupt programming. Programming the External Hardware Interrupts

Basic interfacing concept_ Basic concepts of Interfacing of 8051 to keyboard ,Seven Segment

display, LCD display, Matrix Key Board, Stepper Motor ,DC motor, DAC and ADC with relevant assembly and C-Programs.

Core features of PIC microcontrollers, overview of various PIC microcontroller series.

Text Books

1. The 8051 Microcontroller.

-*Kenneth J Ayala*, II Edn. 1996, Penram Intl. Publishers.

2. The 8051 Microcontroller and Embedded systems.

- *M. A. Mazadi, J.G.Mazadi & D McKinlay*, II Edn., 2000, Prentice-Hall.

Reference Text Books:

1. Programming and Customizing the 8051 Microcontroller.-*Predko*, II Edn, 2003, TMH
2. Microcontrollers: Architecture, Programming, Interfacing and System Design.

- *Raj Kamal*, 2005, Pearson Education,

3. Microcontrollers Theory and Applications. - *Ajay V.Deshmukh*, 2005, TMH.

V Semester B.Sc

PAPER:5SELE5P : **Microcontroller Lab**

Max Marks:35	No. Of Hours/Week:3

About The Course

5SELE5P is designed to serve as a fifth course in an undergraduate B.Sc Electronics Laboratory curriculum.

(Any EIGHT programs)

1. Program to add and subtract two 8-bit numbers.
2. Program to multiply two 8 bit numbers.
3. Program to find the smallest /largest of N one byte numbers
4. Program to arrange the numbers in ascending/ descending order.
5. Timer Programming-Generation of square wave
6. Interfacing a Seven-Segment display
7. Interfacing a DAC.
8. Interfacing a Stepper motor.
9. Interfacing a LCD.
10. Interfacing a Matrix Key Board.

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V Semester B.Sc

PAPER: 5SELE6T: Analog Communication

Total Teaching Hours : 45	No. Of Lecture Hours/Week:3
Max Marks:70	

About The Course

5SELE6T is designed to serve as a sixth course in an undergraduate B.Sc Electronics curriculum. This course introduces students to basics of electronic communication.

Course Objectives

The objectives of the course 5SELE6T

1.To learn the basic principles of analog communication systems.

2. To familiarize the student with modulation techniques.

3. To learn different types of transmitters and receivers.

4. To learn the basic principles of Television communication.

4. To learn the basic principles of Transmission Lines, Antenna and RADAR systems.

Course Outcomes

After studying this course, the students would gain enough knowledge

1. to understand the basic theory and operation of analogue communication systems.

2. of various analogue modulation techniques and transmitters.

3. of various analogue demodulation techniques and receivers

4. to analyze and design simple analogue communications systems.

5. of basic principles of Television Communication.

6. of basic principles of Transmission Lines, Antenna and RADAR systems

UNIT I	Teaching Hours :15

Analog Communication Techniques

Introduction, Block diagram of general communication system.

Radio wave Propagation-e m spectrum-propagation of e m waves.

Modulation -Need for Modulation, Types of Modulation- AM, FM & PM.

Amplitude Modulation – Waveform representation, Modulation Index, Expression for instantaneous voltage. Power Relations in AM, Modulation by several sine waves. Generation of AM.- Collector Modulator .Block Diagram of AM Transmitter. SSB modulation.

Frequency Modulation -Modulation index, percentage of modulation. Expression for Instantaneous Voltage, Frequency Spectrum, Bandwidth Requirements. Generation of FM – Varactor diode Modulator .Block diagram of FM Transmitter .Pre emphasis and de-emphasis

UNIT II	Teaching Hours :08

Radio Receivers

Radio Receivers-Demodulation. AM Detector –- Diode Detector. Characteristics of a Radio Receiver. SHD AM Receiver – Block diagram. FM Detectors – Balanced Slope Detector. SHD FM Receiver - Block diagram. Comparison of AM and FM.

UNIT III	Teaching Hours :12

Transmission Lines and Antenna

Transmission Lines. Equivalent circuit of transmission line. Primary and Secondary constants – L, R, G, C, Z, Y –Characteristic impedance. Propagation Constant, Reflection coefficient and VSWR.

Antenna – Radiation mechanism, elementary doublet, radiation patterns, expression for radiated field – no derivation. Resonant antenna,. Non-resonant antenna. Antenna Parameters- Gain, Directive gain, Power gain, Directivity, Beam width and Bandwidth. Radiation resistance – Expressions for total power radiated and Radiation resistance. Expression for the Radiation efficiency –no derivation. Yagi Antenna

UNIT IV	Teaching Hours :10

TELEVISISON,RADAR and NOISE

TELEVISION-Principles of Transmission and Reception, LED displays,

RADAR –Block diagram of Pulsed RADAR system. RADAR range equation. Applications of RADAR. Lidar.

Noise – Definition of Noise, Types of noise. Signal to Noise Ratio, Noise Figure

Text Books

1.Electronic Communication - Dennis Roddy &John Coolen
- IVth edition –PHI.

2.Electronic Communication systems -Kennedy &Davis
-IVth edition -TATA Mc GRAW hill.

3. Monochrome and Colour TV -R.R Gulati Wiley Eastern Publishers

Reference Text Books:

1.Advanced Electronic Communication systems,-WayneTomasi VIth edition
- Pearson Education.

2. Colour TV Principles & Practice -R.R Gulati
-4TH .Edition'Wiley Eastern Publishers,

3. Electronic Communication systems, Fundamentals through Advanced
-Wayne Tomasi
-4thedition–Pearson Education.

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V Semester B.Sc

PAPER:5SELE6P : **Analog Communication Lab**

Max Marks:35	No. Of Hours/Week:3

About The Course

5SELE6P is designed to serve as a sixth course in an undergraduate B.Sc Electronics Laboratory curriculum.

1. Amplitude Modulator
2. Amplitude Demodulator
3. Frequency Modulator
4. Pre-Emphasis and De-Emphasis
5. Automatic gain control
6. Audio crossover network
7. Frequency mixer
8. Frequency multiplier

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VI Semester B.Sc

PAPER: 6SELE7T: Verilog HDL and VLSI

Total Teaching Hours : 45	No. Of Lecture Hours/Week:3
Max Marks:70	

About The Course

6SELE7T is designed to serve as a seventh course in an undergraduate B.Sc Electronics curriculum.

This course introduces students to basics of Verilog HDL and VLSI

Course Objectives

The objectives of the course 6SELE7T

To acquire the basic knowledge of Verilog HDL and VLSI.

Course Outcomes

After studying this course, the students would gain enough knowledge

1. Basics Verilog HDL
2. Basics of VLSI.

UNIT I	Teaching Hours :15

Introduction to Verilog

A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and Verilog. Introduction to Simulation and Synthesis Tools, Test Benches.

Verilog: Module, Delays, brief description - data flow style, behavioral style, structural style, mixed design style, simulating design-programs.

Language Elements: Introduction, Keywords, Identifiers, White Space Characters, Comments, format, Integers, real's and strings. Logic Values, Data Types-net types, undeclared nets, scalars and vector nets, Register type, Parameters.

Expressions: Operands, Operators, types of Expressions.

Gate level modeling: Introduction, built in Primitive Gates, multiple input gates, Tri-state gates, pull gates, MOS switches, bidirectional switches, gate delay, array instances, implicit nets, Illustrative Examples (both combinational and sequential logic circuits).

UNIT II	Teaching Hours :12

Data flow Modeling, Behavioral Modeling and Structural Modeling

Data flow Modeling: Continuous assignment, net declaration assignments, delays, net delays and examples.

Behavioral Modeling: Procedural constructs, timing controls, block statement, procedural assignments, conditional statement, loop statement, procedural continuous assignment, Illustrative Examples.

Structural Modeling.

UNIT III	Teaching Hours :10

Introduction to VLSI

Evolution of VLSI, MOS and VLSI technology, review of MOSFET,MOS transistor switch-NMOS,PMOS,CMOS switch. NMOS fabrication**, CMOS technology**, BiMOS technology. CMOS and NMOS fabrication process-different stages in fabrication.

UNIT IV	Teaching Hours :08

Basics of VLSI design

VLSI design methodology-introduction, stick diagrams, stic layout, VLSI design rules and layout, elements of physical design, design flow, design hierarchies, concept of regularity, modularity and locality, VLSI design styles.

Text Books

1. A Verilog HDL Primer – *J. Bhasker*, II Edn. 2003, BSP.
2. Verilog HDL - A guide to digital design and synthesis
   - *SAMIR PALNITKAR*, 1999, II Edn. Pearson
3. VLSI design - A.Albert Raj
   -T Latha
   -PHI Publictions

Reference Books:

1. Fundamentals of Logic Design with Verilog – Stephen. *Brown and Zvonko Vranesic*, 3rd Edn, 2005, TMH.
2. Basic VLSI design- Douglas A. Pucknell
   -Kamran Eshraghian
   - PHI Publications

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VI Semester B.Sc

PAPER: 6SELE7P : Verilog HDL and Advanced Communication Lab

Max Marks:35	No. Of Hours/Week:3

About The Course

6SELE7P is designed to serve as a seventh course in an undergraduate B.Sc Electronics Laboratory curriculum.

Experiments on Verilog

1. Write code to realize basic and derived logic gates.
2. Half adder, Full Adder, Half Subtractor using basic and derived gates.
3. Clocked SR FF,D FF and JK FF (with Reset inputs).
4. Multiplexer (4x1, 8x1) and De multiplexer using logic gates.
5. Decoder (2x4, 3x8), Encoders and Priority Encoders.
6. Design and simulation of a 4 bit Adder.
7. Code converters (Binary to Gray and vice versa).
8. 2 bit Magnitude comparator.
9. 3 bit Ripple counter and decade ripple counter
10. 3 bit Synchronous counter and decade counter.

Experiments on Advanced Communication

1. PWM and PPM using IC-555..PAM using transistor.
2. FSK modulation using IC -555.
3. ASK modulation and Demodulation using OP-AMP or transistor.
4. Characteristics of Optical fiber. Transmission and Reception through Optical fiber

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V Semester B.Sc

PAPER: 6SELE8T: Advanced Communication

Total Teaching Hours : 45	No. Of Lecture Hours/Week:3
Max Marks:70	

About The Course

6SELE8T is designed to serve as an eighth course in an undergraduate B.Sc Electronics curriculum.

This course introduces students to advanced Electronic communication and systems.

Course Objectives

The objectives of the course 6SELE8T

To acquire the basic knowledge of

1. Digital Communication systems.
2. orbital mechanics, , satellite communication systems.
3. elements of optical fiber Communication.
4. various optical sources, receivers, different kinds of losses.
5. Mobile radio propagation, cellular system design.
6. Microwave Devices.

Course Outcomes

After studying this course, the students would gain enough knowledge of

1. basics of a digital communication system
2. basics of satellite communication,
3. basics of optical fiber communication.
4. basics of mobile radio communication.
5. Microwave devices.

UNIT I	Teaching Hours :15

Digital Communication

Block diagram of Digital communication system. Digital transmission – Advantages and disadvantages. Pulse modulation – Types: PAM, PWM PPM and PCM, Delta Modulation. Information Capacity, Bit and Baud Rates, M_ARAY Encoding, Hartley's Law, Shannon limit for information capacity, Digital modulation –ASK, FSK , PSK QPSK,16 PSK , QAM and 16 QAM. Characteristics of data transmission circuits –Bandwidth requirement, Data transmission speed, Noise, Crosstalk, and Echo –suppressors. Equalizers,

I^2C (Intra Integrated Circuit) and CAN (Controlled Area Network) Protocols.

UNIT II	Teaching Hours :08

Microwave Devices

Introduction –Characteristic features of microwaves, Applications.

Microwave devices: Two–cavity Klystron amplifier, The Reflex Klystron, Magnetron, Traveling Wave Tube (TWT). Semiconductor Microwave Devices: Gunn Diode, Microwave BJT.

UNIT III | Teaching Hours :12

Satellite Communication

Satellite Communication- Introduction - Kepler's laws, Satellite orbits, Geostationary Satellite. Antenna look angles-Azimuth angle, angle of elevation. Satellite classification – Spacing and frequency allocation.Satellite system link models - Up-link model, transponder, downlink model and Cross-link. Block diagram of satellite systems.

Multiple access methods – FDMA, TDMA, CDMA. Introduction to GPS and GPS services- SPS and PPS.

UNIT IV | Teaching Hours :10

Optical Fiber and Mobile Communication

Optical Fiber Communication-Block diagram of optical fiber communication system, Fiber types, propagation of light through an optical fiber, optical fiber configuration. Critical angle, Acceptance angle, Numerical aperture, Losses in optical fiber cable. Light sources – LED, Laser diode. Light detectors – Photodiode. Advantages and disadvantages of optical fiber

Mobile Communication-Block diagram of cellular radio telephone system, Basic cellular radio Telephone concepts: Frequency reuse and Cell splitting. Incoming and outgoing calls, Call handoff. Mobile Phones, Block diagram of a Mobile Phone. Generation of Mobile Phones.

Text Books

1. Advanced electronic communication systems - *Wayne Thomasi*, - PHI VI Edition
2. Electronic Communications Systems - *Kennedy & Davis*, - TATA Mac Graw -Hill. VI Edition

Reference Text Books:

1. Electronic Communication -*Dennis Roddy* and *John Coolen* - PHI, IV Edition
2. Satellite Communication - *Dennis Roddy*
3. Hand book of experiments in electronics and communication -*Poornachandrarao* & *Sasikala,* - 2004, Vikas publishing house

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VI Semester B.Sc

PAPER: 6SELE8P: Project **Lab**

Max Marks:35	No. Of Hours/Week:3

About The Course

6SELE8P is designed to serve as an eighth course in an undergraduate B.Sc Electronics Laboratory curriculum.

PROJECT

- Students in a group, not exceeding THREE, should Design, Fabricate and Assemble ONE Electronics project. The Department Faculty is required to guide the project work.
- Each student should prepare a report and submit at the time of practical examination viva voce duly certified by the concerned Faculty & HOD.
- Department Faculty shall ensure that the entire project work is carried out in the practical class assigned to practical VIII and the students shall be required to give the Seminar on the project.

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