ST. PHILOMENA'S COLLEGE (AUTONOMOUS) MYSORE 570015
COLLEGE OF EXCELLENCE (UGC)

SUBJECT: **ELECTRONICS**

SYLLABUS FOR B.Sc. COURSE UNDER SEMESTER SCHEME
DURATION OF THE COURSE – THREE YEARS - SIX SEMESTERS
FROM THE ACADEMIC YEAR 2016-17 ONWARDS.

The Scheme of Teaching & Examination

Semester	Title of the paper	Teaching Scheme (hours per week)			Examination scheme			
		Theory	Practical	Credits	Duration in hours	Theory/Practical paper max. marks	IA max. marks	Total marks
I	PAPER 1 ANALOG ELECTRONICS	03	-	3	03	60	10	100
	PRACTICAL PAPER 1 ANALOG ELECTRONICS LAB	-	03	1.5	03	20	10	
II	PAPER 2 DIGITAL ELECTRONICS	03	-	3	03	60	10	100
	PRACTICAL PAPER 2 DIGITAL ELECTRONICS LAB	-	03	1.5	03	20	10	
III	PAPER 3 LINEAR INTEGRATED CIRCUITS	03	-	3	03	60	10	100
	PRACTICAL PAPER 3 LINEAR INTEGRATED CIRCUITS LAB	-	03	1.5	03	20	10	
IV	PAPER 4 TRANSDUCERS AND INSTRUMENTATION	03	-	3	03	60	10	100
	PRACTICAL PAPER 4 INSTRUMENTATION LAB	-	03	1.5	03	20	10	
V	PAPER 5 COMMUNICATION	03	-	3	03	80	20	150
	PRACTICAL PAPER 5 COMMUNICATION LAB	-	03	1.5	03	40	10	
	PAPER 6 VHDL	03	-	3	03	80	20	150
	PRACTICAL PAPER 6 VHDL LAB	-	03	1.5	03	40	10	
VI	PAPER 7 (COMPULSORY) MICROCONTROLLER	03	-	3	03	80	20	150
	PRACTICAL PAPER 7 (COMPULSORY) MICROCONTROLLER LAB AND PROJECT WORK	-	03	1.5	03	35	15	
	PAPER 8.1 (ELECTIVE*) DSP	03	-	3	03	80	20	150
	PAPER 8.1 (ELECTIVE) DSP LAB	-	03	1.5	03	40	10	
	** PAPER 8.2 (ELECTIVE*) C++ PROGRAMMING	03	-	3	03	80	20	150
	** PRACTICAL PAPER 8.2 (ELECTIVE) C++ PROGRAMMING LAB	-	03	1.5	03	40	10	

1. Minimum Eight Experiments Should Be Completed In All Labs.
2. Project Work is compulsory.
3. * One elective to be opted (paper 8.1 or paper 8.2)
4. ** Computer Science students are not eligible for the paper "**Programming in C++**".
5. IA marks for practical includes evaluation of practical record.

FIRST SEMESTER - ELECTRONICS PAPER – I
Title of Paper: **ANALOG ELECTRONICS**

Class duration – 03 hours per week
Marks -Theory - 60 + Internal Assessment - 10 = 70

Objectives

- To provide a comprehensive insight about working principle, operation, characteristics of electronic devices
- To analyze electronic circuits using device models
- To study the application of electronic devices in rectification, voltage regulation, amplification and oscillation

Unit 1: Diode circuits and its applications

Review of PN junction diode characteristics and parameters. Diode circuit analysis.
Analysis of half wave and Bridge rectifiers. Filters: C, LC and PI, Voltage multiplier.
Review of Zener diode characteristics. zener voltage regulator, Three terminal Fixed voltage regulators - (78XX and 79XX). Power supply: power supplies performance.
Special types of Diodes: Schottky, Varactor, PIN and Tunnel Diode.
Numerical examples as applicable. **14hrs**

Unit 2: BJT, UJT, FET and MOSFET

Review of Bipolar junction transistor CE characteristics.
CB and CC characteristics, transistor biasing, DC load line and Q point, fixed bias, voltage divider biasing, stabilization and stability factors – derivation. Numerical examples as applicable.
UJT: characteristics and working applications - relaxation oscillator.
FET: construction and working, characteristics and application, with relevant examples.
MOSFET: enhancement type and depletion type - construction, characteristics and working.
Review of Transistor CE amplifier. h - parameters, analysis of CE amplifier using h – parameters, FET voltage amplifier (CS configuration). Numerical examples as applicable.
14hrs

Unit 3: Amplifier and Oscillators

Amplifier classification, Cascade connection- direct coupled, RC coupled and Transformer coupled amplifier. Tuned Amplifier.
Power amplifiers: Class A, Class B - principle, working and derivation. Class C - principle and working.
Feedback: concepts and connection types, Effect of negative feedback on gain, stability, bandwidth, noise, distortion, input and output impedance.
Oscillator: operation - Barkhausen criterion for oscillation, BJT, RC phase shift, Weinbridge, Hartley, Colpitts and crystal oscillators (BJT version - qualitative discussion only). Numerical examples as applicable.
14hrs

Reference Books:

1. David A. Bell - *Electronic devices and circuits*
2. Robert. L. Boylstead and Louis Nashelsky - *Electronic devices and circuit theory*
3. Dr. R. D. Sudhakar Samuel, U. D. Mahadevaswamy and V. Natarasu - *Electronic circuits*
4. V. K. Mehta - *Principles of Electronics*

PRACTICAL – I **ANALOG ELECTRONICS LAB**

Class duration – 03 hours per week
Marks - Practical Exam - 20 + Internal Assessment - 10 = 30

Any eight of the following experiments :

6. Half wave and bridge rectifiers with and without Capacitor filters
7. Zener Diode voltage regulator - line and load regulation
8. Single stage RC coupled amplifier - frequency response and band width
9. FET Characteristics and determination of parameters
10. FET amplifiers - frequency response and band width
11. UJT Characteristics
12. UJT Relaxation oscillator
13. Single tuned amplifier
14. Hartley or Colpitts oscillator (BJT/FET)
15. RC Phase Shift oscillator
16. Construction of regulated DC power supply
17. Transformer less Class – B push pull power amplifier

SECOND SEMESTER - ELECTRONICS PAPER –II
Title of Paper: **DIGITAL ELECTRONICS**

Class duration – 03 hours per week
Marks - Theory - 60 + Internal Assessment - 10= 70

Objectives

- To study various number systems, code conversions, simplify logical expressions using Boolean algebra
- To study the implementation of combinational and sequential circuits

Unit 1: Number system and Boolean algebra

Binary, Octal and Hexadecimal number systems, Conversion from one system to the other. Addition, multiplication and division in binary systems. Negative number representation. Subtraction in binary system - one's and two's complement methods.
Weighted codes: 8421, 2421, BCD addition. Self complementary codes.
Non weighted codes: Excess 3 code and Gray code.
Alphanumeric codes: ASCII, EBCDIC, UNICODE.
Error detection and correction: Parity, CRC and Hamming code
Review of logic gates. Laws of Boolean algebra, Principle of duality, DeMorgan's theorems. Simplification of Boolean expressions, Boolean expression for logic circuits and vice versa. Universal logic gates - NAND and NOR. Realization of basic gates from Universal gates.

14hrs

Unit 2: Combinational logic circuits and IC Logic families

SOP and POS notations. Canonical Expressions. Conversion from SOP to POS form and vice versa. Reduction of Boolean expressions (three/ four variables with don't care conditions) using Karnaugh maps. Realization of simplified Karnaugh expressions with NAND and NOR gates.
Half Adder, Full Adder, Half Subtractor, Full Subtractor, adder/subtractor circuit, Binary to Gray and Gray to Binary converter, Parity generator and checker, Decoders, Encoders, Multiplexer, Demultiplexer, Magnitude Comparator.
Families of Gates: TTL and CMOS gates, parameters, circuit diagram and working of NAND and NOR gate compatibility.

14hrs

Unit 3: Sequential logic circuits

Flip flops - RS latch, clocked RS and D flip flops, JK and T flip flops, Race Round condition, Master slave JK flip flops.
Shift register - SISO, SIPO, PISO, PIPO registers, Universal shift register.
Counter - Ripple and synchronous binary counters, mod N and decade counters.
Memory ROM - on chip decoding, RAM Memory addressing - linear addressing, matrix addressing. Basic memory cell - MOS memory read and write operations. SRAM and DRAM.
Programmable Logic Devices - PROM, PAL, PLA, CPLD,FPGA

14hrs

Reference Books:

1. Thomas L. Floyd - *Fundamentals of Digital Electronics*
2. Albert Paul Malvino and Donald P. Leach - *Digital Principles and applications*
3. R. D. Sudhakar Samuel - *Logic Design*

Practical – II - **DIGITAL ELECTRONICS LAB**

Class duration – 03 hours per week
Marks - Practical Exam - 20 + Internal Assessment -10 = 30

Any eight of the following experiments :

1. NAND and NOR as Universal gates
2. Realization of Boolean expressions using gates
3. Full adder and Full Subtractor
4. Four bit parallel adder /subtractor using 7483 and 7486
5. Binary to gray and gray to binary converter and Parity generator
6. Encoder and Decoder
7. SR and JK Flipflop, JK Masterslave Flipflop
8. Shift Register
9. 4 to 1 multiplexer and 1 to 4 demuliplexer
10. Modulo-n ripple and synchronous counters
11. Study of RAM 74189.
12. BCD to Seven segment display converter

THIRD SEMESTER - ELECTRONICS PAPER –III

Title of Paper: **LINEAR INTEGRATED CIRCUITS**

Class duration – 03 hours per week

Marks - Theory - 60 + Internal Assessment - 10= 70

Objectives

- To study the basic characteristic, construction, open loop & close loop operations of Op-Amp
- To study linear and non linear applications of Op-Amp
- To study the internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator circuits, Data converters.

Unit 1: OPAMP & its basic applications

The Differencial amplifier: dual input, balanced and unbalanced output - working principle. Introduction to Opamp: Block diagram, Ideal op-amp, op-amp equivalent circuit, ideal voltage transfer curve, Open loop configurations - Inverting and non inverting amplifiers, limitations.
Closed loop inverting amplifiers: virtual short, Inverting and non inverting, Summing, Scaling and averaging amplifiers, Subtracting amplifier, clippers and clampers. op-amp parameters and their measurements. Numerical examples as applicable.

14hrs

Unit 2: Other Opamp applications

Instrumentation amplifiers, Precision Rectifier, Voltage to current and Current to voltage converters, Integrator, Differentiator, Active Filters - first order and second order low pass and high pass Butterworth filters, Band Pass filters, Oscillators - phase shift oscillator, Wein bridge oscillator, Square wave and Triangular wave generators, comparators and Schmitt trigger. Numercial examples as applicable.

14hrs

Unit 3: Data Converters, Regulators and Timers

Digital to analog converters: binary weighted resistor type and R-2R ladder type.
Analog to digital converters: Counter comparator type, Flash, Successive approximation type.
Voltage regulators: Opamp Series and Shunt regulator, IC voltage regulators, LM317 and 337, SMPS.
555 Timer: basic timer circuit, astable and monostable mode - applications, PLL. Numerical examples as applicable.

14hrs

Reference Books:

1. David A. Bell – *Operational amplifiers and Linear ICs*
2. Robert F. Coughlin and Frederick F. Driscoll - *Operational amplifiers and Linear Integrated Circuits*
3. Ramakanth A. Gayakwad - *Op- amps and linear integrated circuits*
4. U. A. Bakshi and A. P. Godse - *Introduction to Linear ICs*

Practical – III **LINEAR INTEGRATED CIRCUITS LAB**

Class duration – 03 hours per week
Marks - Practical Exam - 20 + Internal Assesment - 10 = 30

Any eight of the following experiments :

1. Measurement of op-amp parameters-offset voltage, Input offset and bias current, CMRR and slew rate.
2. Inverting and Non Inverting DC and AC amplifier – gain and frequency response.
3. Op-amp Differentiator and Integrator
4. Op-amp adder and subtractor
5. Op-amp wein bridge oscillator
6. Op-amp phase shift oscillator
7. IC 555 Timer as astable multivibrator
8. IC 555 Timer as monotable multivibrator
9. Opamp triangularwave generator
10. First order low pass and high pass Butter worth filter
11. Voltage regulator – LM317, LM337
12. Frequency synthesis using PLL

FOURTH SEMESTER - ELECTRONICS PAPER –IV
Title of Paper: **TRANSDUCERS AND INSTRUMENTATION**

Class duration – 03 hours per week
Marks - Theory - 60 + Internal Assessment - 10= 70

Objectives

- To study the characteristics of an instrument
- To understand how physical quantities are measured and converted to other forms
- To study the characteristics of different sensors
- To study the measurement techniques of temperature, pressure and flow

Unit 1: Performance Characteristics of Instruments

Elements of measurements system, Instrument types, Static and Dynamic characteristics of Instruments, Errors - Systematic errors and their reduction, Random errors, Signal transmission- Electrical, pneumatic and Fiber optic transmission, Radio telemetry, numerical examples as applicable

14hrs

Unit 2: Sensors and Electronic Instruments

Electronic Measuring Devices: Digital Multimeter and CRO.
Intelligent Devices and Sensor Technologies: Intelligent Devices, Intelligent sensors and transmitters, Capacitive, Inductive and Resistive sensors, Hall effect sensors, Piezoelectric transducers, strain gauges, Piezoresistive sensors, Optical sensors, Ultrasonic transducers, Nuclear sensors, Micro sensors, numerical examples as applicable.

14hrs

Unit 3: Temperature, Pressure and Flow Measurement techniques

Temperature Measurement: Principle of temperature Measurements, Thermoelectric effect sensors, resistance temperature sensors, Semiconductor devices, Radiation thermometers, Intelligent temperature measurement Instruments.
Pressure Measurement: Diaphragms, Capacitive and Fiber optic pressure sensors, Elastic element sensors, Manometers Resonant wire devices, Dead weight gauges, Low pressure and High pressure measurements Intelligent pressure measurements, intelligent pressure transducers.
Flow Measurement: Measurement of Mass Flow Rate and Volume Flow Rate, Intelligent Flow Meters.
Numerical examples as applicable.

14hrs

Reference Books:

1. Alan S. Morris - *Measurement and instrumentation Principle*
2. C. S. Rangan, G. R. Sharma, V. S. V. Mani - *Instrumentation - Devices and System*
3. A. K. Sawhney - *A Course in Electrical and Electronic Measurements and Instrumentation*
4. D. V. S. Murthy – *Transducers and Instrumentation*

Practical – IV **INSTRUMENTATION LAB**

Class duration – 03 hours per week
Marks - Practical Exam - 20 + Internal Assesment -10 = 30

Any eight of the following experiments :

1. Instrumentation amplifier
2. 4-bit DAC using R-2R ladder network and op-amp
3. Analog to Digital converter using ADC 0801.
4. Voltage to current converter
5. Voltage to frequency converter
6. Op-amp voltmeter
7. Characteristics of LDR and optocouplers
8. Implementation of Schmitt trigger op-amp for given values of UTP and LTP
9. Precision rectifier
10. Thermistor Characteristics
11. Capacitance meter using 555 Timer

FIFTH SEMESTER - ELECTRONICS PAPER –V
Title of Paper: **COMMUNICATION**

Class duration – 03 hours per week
Marks - Theory - 80 + Internal Assessment - 20= 100

Objectives

- To study the various modulation and demodulation techniques
- To develop knowledge about the fundamentals of satellite and fiber optic communication

Unit 1: Introduction and Modulation Techniques

Modulation, Amplitude modulation, Frequency Spectrum of AM wave, representation of AM, Power Relation, Current Calculation, Modulation by several sine waves, Generation of AM - transistor modulator circuit.
SSB: Introduction, Suppression of carrier, Balanced Modulator, Suppression of unwanted sideband-Filter system, phase shift method, vestigial sideband transmission.
Frequency and Phase Modulation: Theory of frequency and phase modulation, Frequency spectrum of FM, Observations, Band width, phase Modulation, Intersystem comparison-FM, PM and AM.
Generation of FM: Basic Reactance Modulator, Indirect Method.
Pulse Communication: PAM, PWM, PPM, PCM-Principles of PCM, quantizing noise, advantages and applications of PCM.

14hrs

Unit 2: Demodulation Techniques, Transmission lines and Antennas

Radio Receivers: Super heterodyne receiver (block diagram, explanation)- sensitivity, selectivity, image frequency and its rejection, double spotting, detection and AGC, (Practical diode detector).
FM Demodulator: Slope detector, Balanced Slope detector, Phase discriminator.

Electromagnetic waves.
Transmission Lines: Basic Principles, Characteristics Impedance, Losses in transmission lines, standing waves, quarter and half length lines, reactance properties of transmission lines.
Antennas: Basic consideration, EM radiation elementary doublet wire radiations in space, current and voltage distributions, resonant and non resonant antennas, antenna gain and effective radiated power, field intensity, antenna resistance, band width, beam width, polarization, antenna with parabolic reflector. (Geometry of parabola, properties of paraboloidal reflector).

14hrs

Unit 3: Modern Communication – Satellite and Fiber optics

Satellite Communication: Introduction, Orbits, station keeping, transmission path, path loss, noise considerations. The satellite communication system, saturation flux density, effective isotropic radiated power, multiple access methods.
Fiber optics: Fiber optic systems, characteristics, optical fiber, fiber types, fiber performance, fiber optic sources, optical measurements terminology and parameters, modulating the source, optical detector.

14hrs

Reference Books:

1. George Kennedy - *Electronic Communication System*

2. William Schweber - *Electronic Communication System*
3. Dennis Roddy and Coolen - *Satellite communication*

Practical – V **COMMUNICATION LAB**

Class duration – 03 hours per week
Marks - Practical Exam - 40 + Internal Assesment -10 = 50

Any eight of the following experiments :

1. AM modulation
2. FM modulation
3. PWM using 555 IC
4. PPM using 555 IC
5. Radiation pattern of dipole antennas
6. IF amplifier
7. RF amplifier
8. Analog fiber optic link
9. Radiation pattern of LED
10. Numerical aperture measurement and attenuation losses in fibers
11. Preemphasis and deemphasis circuit
12. Frequency Mixer

FIFTH SEMESTER - ELECTRONICS PAPER –VI
Title of Paper: **VHDL**

Class duration – 03 hours per week
Marks - Theory - 80 + Internal Assessment - 20= 100

Objectives

- To understand the importance of hardware description language
- To design digital systems using hardware description language

Unit 1: Introduction and Behavioral Modeling

Introduction to VHDL, Features, Basic Language Elements: Identifiers, Data Objects, Data Types, Operators.
Behavioral Modeling: Entity Declaration, Architecture Body, Process statement, Variable Assignment Statement, Signal Assignment Statement, Wait Statement, If Statement, Case Statement, Null Statement, Loop Statement, Exit Statement, Next Statement, Assertion Statement, Report Statement.

14hrs

Unit 2: Dataflow and structural modeling

Dataflow Modeling: Concurrent Signal Assignment Statement, Concurrent versus Sequential signal Assignment, Delta Delay, Multiple Drivers, Conditional Signal Assignment Statement, Value of Signal, Generate statement.
Structural Modeling: Component Declaration, Component Instantiation, illustrations using Examples, Resolving Signal values.

14hrs

Unit 3: Generics, Subprograms and Libraries

Generics and Configurations: Introduction to Generics & Configuration, Configuration Specification, Configuration Declaration, Default Rules, Conversion Functions, Direct Instantiation, Incremental Binding.
Subprograms and Overloading: Subprograms, Subprograms Overloading, Operator Overloading, Signatures, Default Values for Parameters.
Packages and Libraries: Packages Declaration, Package Body, Design File, Design Libraries, Order of analysis, Implicit Visibility, Explicit Visibility. **14hrs**

Reference Books:

1. J. Bhaskar - *VHDL Primer*
2. Douglas L. Perry - *VHDL Programming*

Practical – VI **VHDL LAB**
Class duration – 03 hours per week
Marks - Practical Exam - 40 + Internal Assesment -10 = 50

Any eight of the following experiments :

1. Behavioral modeling and simulation of basic gates
2. Structural modeling and simulation of simple Boolean Expressions
3. Modeling and simulation of adders and subtractors
4. Modeling and simulation of Magnitude comparators
5. Modeling and simulation of Flip flops
6. Modeling and simulation of Shift registers
7. Modeling and simulation of Counters
8. Modeling and simulation of Encoders and decoders
9. Modeling and simulation of Multiplexers and Demultiplexers
10. Modeling and simulation of simple ALU
11. Examples using functions and procedures

SIXTH SEMESTER - ELECTRONICS PAPER –VII (Compulsory paper)
Title of Paper: **MICROCONTROLLER**

Class duration – 03 hours per week
Marks - Theory - 80 + Internal Assessment - 20= 100

Objectives

- To study the architecture, instruction set and addressing modes of 8051
- To study the onchip peripherals of 8051
- To interface commonly used peripherals with 8051

Unit 1: Introduction, 8051 architecture and addressing modes

Microprocessor and Microcontrollers: Introduction to Microprocessors and Microcontrollers RISC and CISC CPU architecture, Harvard and Von-Neumann CPU Architecture. The 8051 Architecture: Introduction, Architecture of 8051, pin diagram of 8051, Memory organization, Hardware Input/ output pins, ports and circuits.

8051 Addressing Modes and Data Transfer instructions : Introduction, Addressing Modes, External data, moves, Code Memory, Read Only Data Moves/Indexed Addressing mode, PUSH and POP op codes, Data exchanges, programs.

14hrs

Unit 2: Instruction set and Counter/timer programming

Logical operations: Introduction, Byte level logical operations, Bit level logical operations, Rotate and Swap operations, examples programs.
Arithmetic Operations: Introduction, Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Arithmetic, Examples Programs.
Jump Operations: Introduction, The JUMP and CALL program range, Jump calls and Subroutines, Interrupts and Returns, Example programs.

Counter/Timer: 8051 counter/timer, Programming Timers/counters.

14hrs

Unit 3: Serial port and Interrupt programming and interfacing

Interrupts: 8051 interrupt structure, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication, Interrupts, and Interrupt Priority in the 8051.
Serial communication: 8051 serial port, Programming serial communication.
8051 Interfacing and Application: External Memory Interfacing, Interfacing 8051 to ADC, DAC, Stepper Motor, 8255.

14hrs

Reference Books:

1. Kenneth J. Ayala - *The 8051 Microcontroller Architecture, Programming and Applications*
2. Muhammed Ali Mazidi and Janice Gillispie Mazidi - *The 8051 Microcontroller and Embedded System*
3. Predko - *Programming and Customizing the 8051 microcontroller*

Practical – VII **MICROCONTROLLER LAB**

Class duration – 03 hours per week
Marks - Practical Exam - 30 + Internal Assesment -10 + Project work – 10 = 50

Any eight of the following experiments :

Programming for:

1. Binary addition and Binary Subtraction
2. Binary multiplication and Binary division
3. Finding the smallest and largest numbers from the given N binary numbers
4. To arrange the given numbers in ascending /descending order
5. Code conversion
6. Counters
7. Hex Key board interface to 8051
8. External ADC to 8051
9. Generate different waveforms using DAC interface 8051
10. Stepper motor control interface

Project work is **compulsory**. A report must be submitted for internal evaluation and IA Marks **(Max 10)** is to be awarded for the project work. The work must emphasize significant ideas, concepts and should address the questions-why it is important, where it is applied, what are its key features and limitations.

A group of 3 or 4 students should be made to take up a single project so that they learn the team spirit.

SIXTH SEMESTER - ELECTRONICS PAPER –VIII (Elective paper 8.1)
Title of Paper: **DIGITAL SIGNAL PROCESSING**

Class duration – 03 hours per week
Marks - Theory - 80 + Internal Assessment - 20= 100

Objectives

- To understand the importance of digital signal processing for various applications.
- To understand Z transforms and discrete time Fourier transforms for the analysis of digital signals and systems
- To design and implement FIR & IIR filters and analysis of their frequency response

Unit 1: Signals, systems and Z-transformation

Fundamentals of signals and systems: Introduction, Basic Operations on signals, Basic continuous signals, Basic Discrete- time signals, Properties of systems, convolution sum.
Z-transforms-Introduction, Definition, ROC of finite duration and infinite duration sequences, ROC and Stability, Properties of ROC, properties of Z-transforms, Transforms of some useful sequences, solving difference equations, Inverse Z-transforms using partial fraction expansion method.

14hrs

Unit 2: DFT and Analog Filters

DFT: Introduction to DFT and FFT, Definition of DFT and its inverse, concepts of circular shift and circular symmetry, Properties of DFT.
FFT algorithms: Radix-2 DIT-FFT, Radix-2 DIF-FFT.
Analog filters: Introduction to IIR filters: Analog Filter specifications, classification, Butterworth and chebyshev filters, Frequency transformation/Special transformations, Design of low pass Butterworth filters.

14hrs

Unit 3: Design of Digital Filters

Digital Filters, Bilinear transformation, Analog Design using Digital filters.
Introduction to FIR filters, Symmetric and anti symmetric FIR Filters, Design of Linear Phase FIR filters using windows.
Direct form realization of IIR filters, Parallel realization of IIR filters.

14hrs

Reference Books:

1. Dr. D. Ganesh Rao and Vineetha P. Geggi - *Digital Signal Processing*
2. Proakis and Manolakis - *Digital Signal Processing, Principles algorithm and application*
3. Oppenheim and Schaffer - *Discrete Time Signal Processing*

Practical – VIII **DSP Lab**

Class duration – 03 hours per week

Marks - Practical Exam - 40 + Internal Assesment -10 = 50

Note: MATLAB or Scilab (public domain) may be used for the experiments

Any eight of the following experiments :

Program for

1. Verification of basic operations on signals.
2. Verification of system properties.
3. Finding the DFT of a given sequence using DFT equation and FFT algorithm.
4. Linear and Circular convolution using basic equation and DFT-IDFT method.
5. Verification of sampling theorem.
6. Verification of DFT properties
7. Determination of impulse response of a given system.
8. Determination of response of a given system to any arbitrary input.
9. Design of simple FIR filters.
10. Design of simple IIR filters-Butterworth
11. To determine the auto correlation and cross correlation of sequences.

SIXTH SEMESTER - ELECTRONICS PAPER –VIII (Elective paper 8.2)
Title of Paper: **Programming in C++**

Class duration – 03 hours per week
Marks - Theory - 80 + Internal Assessment -20= 100

Objectives

- To develop object oriented programming skills

Unit 1: Fundamentals and functions

Introduction: Procedure-oriented programming, Concepts of Object-oriented programming, benefits of OOP, Applications of OOP, Structure of C++ program.
Fundamentals: Tokens, Keywords, Identifiers and constants, Basic Data Types, User-defined data types, Derived data Types, Symbolic constants, Type compatibility, Declaration of variables, Dynamic initialization of variables, Reference variables, Operators in C++, Scope resolution operator, Member dereferencing operators, Memory management operators, Manipulators, Type cast operator, Expressions and their types, Special assignment expressions, Implicit conversions, Operator overloading, Operator precedence, Control structures.
Functions: The main function, Function prototyping, Call by Reference, Return by Reference, Inline functions, Default arguments, const arguments, Function overloading, Friend and Virtual functions.

14hrs

Unit 2: Classes, Objects, Constructors and Destructors

Classes and Objects: Specifying a Class, Defining member functions, Making an Outside function Inline, Nesting of member functions, Private member functions, Arrays within a Class, Static data members, Static member functions, Arrays of Objects, Objects as function arguments, friendly functions, Returning Objects, const member functions, Pointers to members.
Constructors and Destructors: Constructors, Parameterized constructors, Multiple constructors in a class, Constructors with default arguments, Dynamic initialization of objects, Copy constructor, Dynamic constructor, Constructing Two-dimensional arrays, const Objects, Destructors.

14hrs

Unit 3: Operator Overloading, Type conversions, Inheritance and Polymorphism

Operator Overloading and Type Conversions: Defining operator overloading, Overloading unary operators, Overloading Binary operators (+/-,^), Rules for overloading operators, Type conversions.
Inheritance and Polymorphism: Introduction, defining derived classes, single inheritance, making a private member inheritable, multilevel inheritance, hierarchical inheritance, hybrid inheritance, virtual base classes, abstract classes, constructors in derived classes, polymorphism – introduction, pointers, pointers to objects, this pointers, pointers to derived classes, virtual functions, pure virtual functions.

14hrs

Reference Books:

1. E. Balaguruswamy - *Object Oriented Programming with C++*
2. M.T. Somashekara, D.S. Guru,H.S. Nagendraswamy, K.S. Manjunatha - *Object Oriented Programming with C++*

Practical – VIII **C++ Lab**

Class duration – 03 hours per week
MARKS-Practical Exam - 40 + Internal Assesment -10 = 50

Any eight of the following experiments :

Program

1. To find square root of a quadratic equation
2. To find the sum of all elements for two dimensional array
3. To fine maximum and minimum element in an array
4. To search an element using binary search
5. To swap two numbers using call by reference
6. To illustrate infinite functions
7. To perform unary ! (NOT) operator overloading
8. To create a class called 'Bark' and to accept two customers data
9. To create a class called 'Employee' and to compute gross salary of employees
10. To create a class called 'Student' and to accept and to display necessary details of student using nested class
11. To create a class called 'Employee'. Accept and display details of employees using arrays of objects
12. To create a class called 'String' with data members name and length. Perform string contatination using string dynamic constructor
13. To illustrate single inheritance
14. To illustrate multilevel inheritance