# FACULTY OF ENGINEERING

## Scheme of Instruction & Examination

## and

## Syllabi

## B.E. Vand VI Semester

## of

## Four Year Degree Programme

## In

## Electronics and Communication Engineering

(With effect from the Academic Year 2018– 2019)
(As approved in the Faculty Meeting held on 26 June 2018)

Issued by

**Dean, Faculty of Engineering**

**Osmania University, Hyderabad**

**July 2018**

**SCHEME OF INSTRUCTION & EXAMINATION**

**B.E. V- SEMESTER**

**(ELECTRONICS AND COMMUNICATION ENGINEERING)**

| S. No. | Course Code | Course Title | Scheme of Instruction | | | | Scheme of Examination | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P/D | Contact Hrs/Wk | CIE | SEE | Duration in Hrs | |
| **Theory Courses** | | | | | | | | | | |
| 1 | **PC501EC** | Linear ICs and Applications | 3 | 1 | - | 4 | 30 | 70 | 3 | 3 |
| 2 | **PC502EC** | Analog Communication | 3 | - | - | 3 | 30 | 70 | 3 | 3 |
| 3 | **PC503EC** | Digital Signal Processing | 3 | 1 | - | 4 | 30 | 70 | 3 | 3 |
| 4 | **PC504EC** | Automatic Control Systems | 3 | 1 | - | 4 | 30 | 70 | 3 | 3 |
| 5 | **PC505EC** | Computer Organization & Architecture | 3 | 1 | - | 4 | 30 | 70 | 3 | 3 |
| 6 | **PC506EC** | Digital System Design with Verilog HDL | 3 | - | - | 3 | 30 | 70 | 3 | 3 |
| 7 | **MC901EG** | Gender Sensitization | 3 | - | - | 3 | 30 | 70 | 3 | 0 |
| **Practical/Laboratory Courses** | | | | | | | | | | |
| 8 | **PC551EC** | IC Applications lab | - | - | 2 | 2 | 25 | 50 | 3 | 1 |
| 9 | **PC552EC** | Systems and Signal Processing Lab | - | - | 2 | 2 | 25 | 50 | 3 | 1 |
| 10 | **PC553EC** | Industrial Visit | - | - | - | - | G | - | - | - |
| **Total** | | | **18** | **4** | **4** | **29** | **260** | **590** | | **20** |

**PC**: Professional Course **MC**: Mandatory Course

**L**: Lecture **T:** Tutorial **P**: Practical **D**: Drawing **G**: Grade (E/VG/G/S/U)

**CIE**: Continuous Internal Evaluation **SEE**: Semester End Examination (Univ. Exam)

**Note:**

1. Each contact hour is a Clock Hour.
2. The Practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.

| Course Code | Course Title | | | | | | Core / Elective |
|---|---|---|---|---|---|---|---|
| PC501EC | **LINEAR ICs AND APPLICATIONS** | | | | | | Core |
| Prerequisite | Contact Hours per Week | | | | CIE | SEE | Credits |
| AEC (PC401EC) | L | T | D | P | | | |
| | 3 | 1 | - | - | 30 | 70 | 3 |

**Course Objectives:**

- Describe various configurations of Op-amp.
- Describe the basic principles and practical limitations of Op-amp.
- Describe the various linear and nonlinear applications of Op-amp.
- Describe frequency generators, active filters and voltage regulators.
- Discuss the operation of the most commonly used D/A and A/D converters.

**Course Outcomes:**

- Illustrate various configurations of Op-amp.
- Illustrate the basic principles and practical limitations of Op-amp.
- Design Linear and Non-linear circuits using Op-amp
- Analyze Frequency generators active filters and voltage regulators.
- Design and analyze ADC & DAC converters.

**UNIT - I**

**Differential Amplifiers:** Classification, DC and AC analysis of single / dual input Balanced and unbalanced output Configurations of Differential amplifiers using BJTs, Level Translator.

**Operational Amplifier:** Ideal, Practical, General (741) bipolar Operational Amplifier, AC and DC performance characteristics, Frequency Compensation, Open-loop and close-loop configurations, 741 Manufacturers data sheet- description, specifications and packages.

**UNIT -II**

**Operational Amplifier Applications-I:** Adder, subtractor, Ideal and practical integrator & differentiator, Voltage to current converter, current to voltage converter, differential amplifier, instrumentation amplifier, Log and antilog amplifiers.

**UNIT - III**

**Operational Amplifier Applications -II:** Comparator, Precision rectifier, Peak detector, Clippers, Clampers, Sample-and-Hold circuits.

**Active Filters** Introduction – First order, Second order Active filters – LP, HP, BP, BR and All pass.

**UNIT - IV**

**Waveform Generators:** Square wave, Monostable Multivibrator, Schmitt Trigger, saw tooth & Triangular wave generators. Voltage Controlled Oscillator, PLL, NE 555 and its applications. Function Generator –8038.

**UNIT - V**

**Voltage Regulators:** Basic of voltage Regulators, Linear regulators using opamp, IC Regulators 78XX and 723.

**Data Converters:** Introduction, Digital to Analog Converters: Weighted Resistor DAC & Inverted R-2R Ladder DAC. Analog to digital Converters: Parallel Comparator ADC, Successive Approximation ADC and Dual Slope ADC. DAC and ADC specifications.

***Suggested Readings:***

1. David A Bell, "Operational Amplifiers and Linear ICs," 3/e, Oxford Publications, 2011.
2. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits," 4/e, PHI, 2010.
3. D.Roy Chowdhury, Shail B.Jain, "Linear Integrated Circuits", 4/e, New / Age International (P) Ltd., 2008.

| Course Code | CourseTitle | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| PC502EC | **ANALOG COMMUNICATION** | | | | | | Core |
| Prerequisite | Contact Hours per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| SATT (PC 304EC) | 3 | - | - | - | 30 | 70 | 3 |

**Course Objectives:**

1. To analyze the analog communication system requirements
2. To understand the generation & detection of various analog modulation techniques
3. To analyze the noise performance of analog modulation techniques
4. To understand AM and FM receivers
5. To understand the pulse modulation techniques

**Course Outcome:**

1. Understand analog communication system
2. Compare and analyze analog modulation techniques
3. Calculate noise performance of analog modulation techniques
4. Design AM and FM receivers
5. Differentiate between pulse modulation techniques & continuous modulation techniques.

**Unit-I**

**Linear Modulation schemes:** Need for modulation, conventional Amplitude Modulation (AM). Double side band suppressed carrier (DSB –SC) modulation, Hilbert transform, properties of Hilbert transform. Pre-envelop. Complex envelope representation of band pass signals, In-phase and Quadrature component representation of band pass signals. Low pass representation of band pass systems. Single side band (SSB) modulation and Vestigial-sideband (VSB) modulation. Modulation and demodulation of all the modulation schemes, COSTAS loop.

**Unit – II**

**Angle modulation schemes:** Frequency Modulation (FM) and Phase modulation (PM), Concept of instantaneous phase and frequency. Types of FM modulation: Narrow band FM and wide band FM. FM spectrum in terms of Bessel functions. Direct and Indirect (Armstrong's) methods of FM Generation. Balanced discriminator, Foster–Seeley Discriminator ,Zero crossing detector and Ratio detector for FM demodulation. Amplitude Limiter in FM.

**Unit-III**

**Analog pulse modulation schemes:** Sampling of continuous time signals. Sampling of low pass and band pass signals. Types of sampling. Pulse Amplitude Modulation (PAM) generation and demodulation. Pulse time modulation schemes: PWM and PPM generation and detection. Time Division Multiplexing.

**Unit-IV**

**Transmitters and Receivers:** Classification of transmitters. High level and low level AM transmitters. FM transmitters. Principle of operation of Tuned radio frequency (TRF) and super heterodyne receivers. Selection of RF amplifier. Choice of Intermediate frequency. Image frequency and its rejection ratio Receiver characteristics: Sensitivity,Selectivity, Fidelity, Double spotting, Automatic Gain Control.

**Unit-V**

**Noise Sources and types:** Atmospheric noise, Shot noise and thermal noise. Noise temperature. Noise in two-port network: noise figure, equivalent noise temperature and noise bandwidth. Noise figure and equivalent noise temperature of cascade stages. Narrow band noise representation. S/N ratio and Figure of merit calculations in AM, DSB-SC, SSB and FM systems,Pre-Emphasis and De-Emphasis.

***Suggested Reading:***

1. Simon Haykin, "*Communication Systems*," 2/e, Wiley India, 2011.
2. B.P. Lathi, Zhi Ding, "Modern Digital and Analog Communication Systems", 4/e, Oxford University Press, 2016
3. P. Ramakrishna Rao, "*Analog Communication*," 1/e, TMH, 2011.

| Course Code | Course Title | | | | | | Core / Elective |
|---|---|---|---|---|---|---|---|
| PC503EC | **DIGITAL SIGNAL PROCESSING** | | | | | | Core |
| Prerequisite | Contact Hours per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| SATT PC 304 EC | 3 | 1 | - | | 30 | 70 | 3 |

**Course Objectives:**

1. Describe the necessity and efficiency of digital signal processing.
2. Design and implementation of FIR and IIR digital filters.
3. Describe the basics of Multirate digital signal processing and its application.
4. Describe the DSP processor architecture for the efficient implementation of digital filters.

**Course Outcomes:**

1. Necessity and use of digital signal processing and its application.
2. Analyze FIR and IIR digital filters.
3. Applications of Multirate digital signal processing.
4. Acquaintance of DSP processor and its architecture.

**UNIT I:**

**Discrete and Fast Fourier Transform:**Discrete Fourier Transform (DFT), Computation of DFT- Linear and Circular Convolution, FFT algorithms: Radix-2 case, Decimation in Time and Decimation in Frequency algorithms- in place computation- bit reversal.

**UNIT II:**

**Digital Filter (IIR) Design:**Butterworth and Chebychev approximation- IIR digital filter design techniques- Impulse Invariant technique- Bilinear transformation technique- Digital Butterworth&Chebyshev filters.

**UNIT III:**

**Digital Filters (FIR) Design:**Amplitude and phase responses for FIR filters- Linear phase filters- Windowing techniques for design of Linear phase FIR filters- Rectangular, Bartlett, Hamming, Hanning, Kaiser windows- realization of filters- Finite word length effects, Comparison between FIR and IIR filters.

**UNIT IV:**

**Multirate Digital Signal Processing:**Introduction- Decimation by factor D and interpolation by a factor I- Sampling Rate conversion by a Rational factor I/D- Implementation of Sampling Rate conversion- Multistage implementation of Sampling Rate conversion- Sampling conversion by a Arbitrary factor, Application of Multirate Signal Processing.

**UNIT V:**

**Introduction to DSP Processors:**Difference between DSP and other microprocessors architecture- their comparison and need for ASP, RISC and CPU- General purpose DSP processors: TMS 320C 54XX processors, architecture, addressing modes- instruction set.

***Suggested Reading:***

1. Alan V. Oppenheim and Ronald W. Schafer, *"Digital Signal Processing"*, 2/e, PHI, 2010.
2. John G. Praokis and Dimtris G. Manolakis, *"Digital Signal Processing: Principles, Algorithms and Application"*, 4/e, PHI, 2007.
3. Avathar Singh and S. Srinivasan, *"Digital Signal Processing using DSP Micrprocessor"*, 2/e, Thomson Books, 2004.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| PC504EC | **AUTOMATIC CONTROL SYSTEMS** | | | | | | Core |
| Prerequisite | Contact Hours per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| SATT<br>PC 304EC | 3 | 1 | - | - | 30 | 70 | 3 |

**Course Objectives:**

1. To Analyze the stability and performance of dynamic systems in both time and frequency domain.
2. To design feedback controllers, such as PID, lead and lag compensators, to meet desired system performance specifications.
3. To provide knowledge of state variable models and fundamental notions of state model design.
4. To understand the classical methods of control engineering and physical system modeling by linear differential equations.
5. To understand state space representation of control systems

**Course Outcomes:**

1. Convert a given control system into equivalent block diagram and transfer function
2. Analyze system stability using time domain techniques
3. Analyze system stability using frequency domain techniques
4. Design a digital control system in the discrete time domain
5. Analyze a control system in the state space representation.

**UNIT – I**

**Control System fundamentals and Components:** Classification of control systems including Open and Closed loop systems,. Transfer function representation: Block diagram representation, Block diagram algebra and reduction and Signal flow graphs and Mason's gain formula.

**UNIT – II**

**Time Response:** Transfer function and types of input. Transient response of second order system for step input. Time domain specifications. Characteristic Equation of Feedback control systems Types of systems, static error coefficients, error series,
**Stability:** Concept of Stability, Routh-Hurwitz criterion for stability, Root locus technique and its construction.

**UNIT – III**

**Frequency response plots:** Bode plots, frequency domain specifications. Gain and Phase margin. Principle of argument. Nyquist plot and Nyquist criterion for stability.
**Compensation:** Cascade and feedback compensation. Phase lag, lead and lag-lead compensators. PID controller.

**UNIT – IV**

**Discrete Control Systems:** Digital control, advantages and disadvantages, Digital control system architecture. The discrete transfer function. Sampled data system. Transfer function of sample data systems. Analysis of Discrete data systems.

**UNIT – V**

**State space representation:** Concept of state and state variables. State models of linear time invariant systems, State transition matrix, Solution of state equations. Controllability and Observability.

***Suggested Reading:***

1. Nagrath, I.J, and Gopal, M., "*Control System Engineering*", 5/e, New Age Publishers, 2009
2. Nagoor Kani*.," Control systems*", Second Edition, RBA Publications.
3. Ogata, K., "*Modern Control Engineering*", 5/e, PHI.

| Course Code | Course Title | | | | | | Core/ Elective |
|---|---|---|---|---|---|---|---|
| PC505EC | **COMPUTER ORGANIZATION AND ARCHITECTURE** | | | | | | Core |
| Prerequisite | Contact Hours per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| STLD PC 302 EC | 3 | 1 | - | - | 30 | 70 | 3 |

**Course Objectives:**

1. Implement the fixed-point and floating-point addition, subtraction, multiplication & Division.
2. Describe the basic structure and operation of a digital computer.
3. Discuss the different ways of communicating with I/O devices and standard I/O interfaces.
4. Analyze the hierarchical memory system including cache memories and virtual memory.
5. Understand issues affecting modern processors.

**Course Outcomes:**

1. Perform mathematical operations on fixed and floating point digital data
2. Illustrate the operation of a digital computer
3. Understand I/O interfacing of a computer
4. Interface microprocessor with memory devices
5. Understand latest trends in microprocessors

**Unit- I**

**Data representation and Computer arithmetic:** Introduction to Computer Systems, Organization and architecture, evolution and computer generations; Fixed point representation of numbers, digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non-restoring algorithms. Floating point representation with IEEE standards and its arithmetic operations.

**Unit-II**

**Basic Computer organization and Design:** Instruction codes, stored program organization, computer registers and common bus system, computer instructions, timing and control, instruction cycle: Fetch and Decode, Register reference instructions; Memory reference instructions. Input, output and Interrupt: configuration, instructions, Program interrupt, Interrupt cycle, Micro programmed Control organization, address sequencing, micro instruction format and micro program sequencer.

**Unit-III**

**Central Processing Unit:** General register organization, stack organization, instruction formats, addressing modes, Data transfer and manipulation, Program control. CISC and RISC: features and comparison. Pipeline and vector Processing , Parallel Processing, Pipelining, Instruction Pipeline, Basics of vector processing and Array Processors.

**Unit-IV**

**Input-output organization:** I/O interface. I/O Bus and interface modules, I/O versus Memory Bus. Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt driven I/O, Priority interrupt; Daisy chaining, Parallel Priority interrupt. Direct memory Access, DMA controller and transfer. Input output Processor , CPU-IOP communication, I/O channel.

**Unit- V**

**Memory organization:** Memory hierarchy, Primary memory, Auxiliary memory, Associative memory, Cache memory: mapping functions, Virtual memory: address mapping using pages, Memory management.

***Suggested Reading:***

1. Morris Mano, M., "*Computer System Architecture*," 3/e, Pearson Education, 2005.
2. William Stallings, "*Computer Organization and Architecture: Designing for performance*," 7/e, Pearson Education, 2006.
3. John P. Hayes, "*Computer Architecture and Organization*," 3/e, TMH, 1998.

| Course Code | Course Title | | | | | | Core/ Elective |
|---|---|---|---|---|---|---|---|
| PC506EC | **DIGITAL SYSTEM DESIGN THROUGH VERILOG HDL** | | | | | | Core |
| Prerequisite | Contact Hours per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| STLD PC 302 EC | 3 | 0 | - | - | 30 | 70 | 3 |

**Course Objectives:**

1. Describe verilog HDL and develop digital circuits using gate level and data flow modeling
2. Develop verilog HDL code for digital circuits using switch level and behavioral modeling
3. Design and develop of digital circuits using Finite State Machines(FSM)
4. Prepare Algorithmic State Machines(ASM) of Digital design
5. Describes designing with Programmable Logic Devices (PLD's).

**Course Outcomes:**

1. Appreciate the constructs and conventions of the verilog HDL programming in gate level and data flow modeling.
2. Generalize combinational circuits in behavioral modeling and concepts of switch level modeling
3. Design and analyze digital systems and finite state machines.
4. Comprehend advanced features of verilog HDL and apply them to design complex real time digital system using ASMs
5. Design various circuits for memory devices and annotate the ASIC/FPGA design flow

**Unit I**

**Introduction to HDLs,**Overview of Digital Design with Verilog HDL, Basic Concepts, Data types, System tasks and Compiler Directives. Hierarchical modeling, concepts of modules and ports. Gate level Modeling, Dataflow modeling-Continuous Assignments, Timing and Delays. Programming Language Interface.

**Design of Arithmetic Circuits using Gate level/ Data flow modeling –**Adders, Subtractors**,** 4-bit Binary and BCD adders and 8-bit Comparators.
**Verification:** Functional verification, simulation types, Design of stimulus block.

**Unit II**

**Switch Level Modeling and examples. Behavioral Modeling:** Structured Procedures, Procedural Assignments, Timing Controls, and Conditional Statements, multi-way branching, Loops, Sequential and Parallel blocks, Generate blocks. Tasks and Functions.
**Behavioral/dataflow modeling of basic MSI combinational logic modules:** ALUs, Encoders, Decoders, Multiplexers, Demultiplexers, Parity generator/checker circuits, Bus Structure.
Basic concepts of Static timing analysis, Logic synthesis

**Unit III**

**Behavioral modeling of sequential logic modules:** Latches, Flip Flops, counters and shift registers applications.
**Synchronous Sequential Circuits: A**nalysis and synthesis of synchronous sequential circuits: Mealy and Moore FSM models for completely and incompletely specified circuits,State Minimization-Partitioning Minimization Procedure, sequence detector with verilog HDL modeling.Design of a Modulo-8 Counter using the Sequential Circuit Approach and its verilog implementation. One-Hot Encoding .

**Unit IV**

**Algorithmic State Machines (ASMs):**ASM chart, ASM block, simplifications and timing considerations with design example. ASMD chart for binary multiplier and Verilog HDL code, one hot state controller.
**Asynchronous Sequential logic:** Analysis procedure-Transition table, flow table, race conditions. Hazards with design example of Vending-Machine Controller

**Unit V**
**Introduction to ASIC's:** Full-custom, standard-cell and Gate array based ASICs. SPLDs: PROM, PAL, GAL, PLA. FPGA and CPLD simplified architecture and applications. ASIC/FPGA Design flow, CAD tools. Combinational circuit Design with Programmable logic Devices (PLDs).

***Suggested Reading:***

1. Samir Palnitkar, "Verilog HDL A Guide to Digital Design and Synthesis," 2nd Edition, Pearson Education, 2006.
2. M. Morris Mano, Michael D. Ciletti, "Digital Design", 4th edition, Pearson Education.
3. Michael John Sebastian Smith, *Application Specific Integrated Circuits*, Pearson Education Asia, 3rd edition 2001.
4. Stephen Brown and Zvonko Vranesic,"*Fundamentals of Digital Logic with Verilog Design*",McGraw Hill.

| Course Code | Course Title | | | | | | Core / Elective |
|---|---|---|---|---|---|---|---|
| MC901EG | **GENDER SENSITIZATION** | | | | | | Core |
| Prerequisite | Contact Hours perWeek | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| - | 3 | 0 | 0 | 0 | 30 | 70 | 0 |

**Course Objectives:**

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To introduce students to information about some key biological aspects of genders.
4. To help students reflect critically on gender violence.
5. To expose students to more egalitarian interactions between men and women.

**Course Outcomes:**

Students will be able to

1. Students will have developed a better understanding of important issues related to gender in contemporary India.
2. Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
3. Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
4. Students and professionals will be better equipped to work and live together as equals.
5. Students will develop a sense of appreciation of women in all walks of life.

**UNIT-I**

**UNDERSTANDING GENDER:Why Should We Study It? Socialization:Making Women,Making Men:** Introduction-Preparing for Womanhood-Growing up male-First lessons in caste-Different Masculinities; **Just Relationships: Being Together as Equals:** Mary Kom and Onler-Love and acid just do not mix-Love Letters-Mothers and Fathers-Further reading: Rosa Parks-The brave heart.

**UNIT-II**

**GENDER AND BIOLOGY: Missing Women: Sex selection and Its Consequences –** Declining sex ratio. Demographic Consequences; **Gender Spectrum: Beyond the Binary –** Two or many – Struggles with discrimination; **Our Bodies, Our Health.**

**UNIT-III**

**GENDER AND LABOUR: Housework: the Invisible Labour:** "My mother doesn't work"- Share the Load"; **Women's Work; Its Politics and Economics:** Fact and fiction-Unrecognized and unaccounted work- Wages and conditions of work.

**UNIT-IV**

**ISSUES OF VIOLENCE: Sexual Harassment: Say No! :** Sexual harassment – not eve-teasing-Coping with everyday harassment-"Chupulu"; **Domestic Violence: Speaking Out:** Is home a safe place? When women unite-Rebuilding lives-New forums for justice; **Thinking about Sexual Violence:** Blaming the victim – "I fought for my life". The caste face of violence.

**UNIT – V**

**GENDER STUDIES: Knowledge - Through the Lens of Gender** - Point of view - Gender and the structure of knowledge – Unacknowledged women artists of Telangana: **Whose History? Questions for Historians and Others:** Reclaiming a past-Writing other histories-Missing pages from modern Telangana history.

***Suggested Readings:***

1. A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu, *"Towards a World of Equals: A Bilingual Text book on Gender"* Telugu Akademi, Hyderabad, 1st Edition, 2015.
2. www.halfthesky.cgg.gov.in

| Course Code | Course Title | | | | | | Core / Elective |
|---|---|---|---|---|---|---|---|
| PC551EC | **IC APPLICATIONS LAB** | | | | | | Core |
| Prerequisite | Contact Hours perWeek | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| LICA<br>PC 501EC<br>STLD<br>PC302EC | 0 | 0 | 0 | 2 | 25 | 50 | 1 |

**Course Objectives:**

- Design and analyze the various linear application of Op-amp.
- Design and analyze the active filters circuit using Op-amp.
- Design and analyze oscillators and Multivibrators using Op-amp & 555.
- Design sequential circuits- Counters &Registers.

**Course Outcomes:**

- Implement operational amplifiers Linear & Non-linear circuits.
- Implement Active filters using Op-amps.
- Implement oscillators, Multivibrators,etc., using Op-amps.
- Illustrate sequential circuits – Counters & Registers

## PART- A

1. Measurement of op-Amp. Parameters, Voltage follower.
2. Inverting and non- Inverting amplifiers using Op-Amp.
3. Integrator Differentiator circuits using Op-Amp.
4. Active filters : LP, HP and BP filters using Op-Amp.
5. Clipper and clamper circuit using Op-Amp.
6. Triangular wave generator using Op-Amp.
7. Monostable and Astable multivibrator using Op-Amp.
8. Monostable and Astable multivibrator using 555 Timer.
9. IC voltage regulator.
10. Voltage controlled oscillator – NE 565
11. Four bit ADC and DAC using Op Amp

## PART - B

1. Flip Flop conversions and latches using gates and ICs.
2. Designing Synchronous, Asynchronous up/ down counters.
3. Shift Registers and Ring counters using IC Flip-Flop & Standards IC counters.
4. Interfacing counters with 7-segment LED /LCD display units.
5. Mux – Demux applications.

**Note:** Atleast ten experiments should be conducted in the semester, of which three should be from PART - B.

***Suggested Readings:***

1. D.Roy Chowdhary, B.Jain Shail - Linear Integrated circuit, 4th Edition.
2. Jain R.P., "Modern Digital Electronics" 3/e TMH 2003.

<table>
<tr><td>Course Code</td><td colspan="5">Course Title</td><td>Core / Elective</td></tr>
<tr><td>PC552EC</td><td colspan="5">SYSTEMS AND SIGNAL PROCESSING LAB</td><td>Core</td></tr>
<tr><td rowspan="2">Prerequisite</td><td colspan="4" rowspan="2">Contact Hours per Week</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td><td rowspan="2">Credits</td></tr>
<tr><td rowspan="2">SATT<br>PC 304 EC<br>DSP<br>PC 503 EC</td><td>L</td><td>T</td><td>D</td><td>P</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>2</td><td>25</td><td>50</td><td>1</td></tr>
</table>

**Course Objectives:**

1. Implement the basic algorithms of DFT,IDFT,FFT and IFFT.
2. Design FIR Filter with specific magnitude and phase requirements.
3. Design IIR Filter with specific magnitude and phase requirements.
4. Describe the basics of Multirate signal processing.
5. Design and implement digital filters on DSP processors.

**Course Outcomes:**

1. Illustrate various signal processing algorithms.
2. Analyze FIR Filter with specific magnitude and phase requirements.
3. Analyze IIR Filter with specific magnitude and phase requirements.
4. Illustrate the basics of Multirate signal processing.
5. Analyze digital filters on DSP processors.

## PART-A
## Signal Processing Experiments

1. Introduction to Software used with details of some basics.
2. DFT andFFT algorithm.
3. Linear convolutions.
4. Circular Convolutions.
5. FIR filters design using different window functions.
6. IIR filters design: Butterworth and Chebyshev.
7. Interpolation and Decimation.
8. Implementation of multi-rate systems.
9. Time response of non –linear systems.
10. Design of P, PI, PD and PID controllers (any two)

## PART-B
## DSP Processor Experiments

1. Introduction to DSP processor kits and Software used with details of some basics.
2. Solution of difference equations.
3. Impulse Response.
4. Linear Convolution.
5. Circular Convolution.
6. Study of procedure to work in real-time.
7. Fast Fourier Transform Algorithms.
8. Design of FIR (LP/HP) USING windows: (a) Rectangular (b) Triangular (c) Hamming windows.
9. Design of IIR (HP/LP) filters.

**NOTE:**

1. Atleast ten experiments to be conducted in the semester.
2. Minimum of 5 from Part A and 5 from Part B is Compulsory.
3. For Section 'A' MATLAB with different toolboxes like signal processing,signal processing
4. Block set and SIMULINK / MATHEMATICA / any popular software can be used.

***Suggested Reading:***

1. Jaydeep Chakravorthy, ''Introduction to MATLAB Programming: Toolbox and Simulink",1/e, University Press,2014.

<table>
<tr><td>Course Code</td><td colspan="5">Course Title</td><td>Core / Elective</td></tr>
<tr><td>PC553EC</td><td colspan="5">INDUSTRIAL VISIT</td><td>Core</td></tr>
<tr><td rowspan="2">Prerequisite</td><td colspan="4" rowspan="2">Contact Hours perWeek</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td><td rowspan="2">Credits</td></tr>
<tr><td rowspan="2">-</td></tr>
<tr><td>L</td><td>T</td><td>D</td><td>P</td><td></td><td></td><td></td></tr>
<tr><td></td><td>-</td><td>-</td><td>-</td><td>-</td><td>Grade</td><td>-</td><td>0</td></tr>
<tr><td colspan="8">Course Objective:<br><br>1. Able to assimilate and keep up abreast with the latest knowhow in the field of ECE Engineering<br>2. Able to articulate the observations they have made during their visit.<br>3. Demonstrate to skills of writing an engineering technical report.</td></tr>
</table>

Students are expected to visit at least two industries during the semester and submit a detailed technical report about the visit. The department should evaluate the reports through a committee consisting of two faculty members to award the grades listed below

Grade: Excellent / Very Good / Good/ Satisfactory / Unsatisfactory

**SCHEME OF INSTRUCTION & EXAMINATION**
**B.E. VI- SEMESTER**
**(ELECTRONICS AND COMMUNICATION ENGINEERING)**

| S. No. | Course Code | Course Title | Scheme of Instruction | | | | Scheme of Examination | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P/D | Contact Hrs/Wk | CIE | SEE | Duration in Hrs | |
| **Theory Courses** | | | | | | | | | | |
| 1 | **PC601EC** | Digital Communication | 3 | 1 | 0 | 4 | 30 | 70 | 3 | 3 |
| 2 | **PC602EC** | Antennas and wave propagation | 3 | 1 | 0 | 4 | 30 | 70 | 3 | 3 |
| 3 | **PC603EC** | Microprocessor and Microcontroller | 3 | 1 | 0 | 4 | 30 | 70 | 3 | 3 |
| 4 | **HS604EC** | Managerial Economics & Accountancy | 3 | 0 | 0 | 3 | 30 | 70 | 3 | 3 |
| 5 | **PE – I** | Professional Elective-I | 3 | 0 | 0 | 3 | 30 | 70 | 3 | 3 |
| 6 | **OE – I** | Open Elective-I | 3 | 0 | 0 | 3 | 30 | 70 | 3 | 3 |
| **Practical/Laboratory Courses** | | | | | | | | | | |
| 7 | **PC651EC** | Communication Lab | 0 | 0 | 2 | 2 | 25 | 50 | 3 | 1 |
| 8 | **PC652EC** | Microprocessor and Microcontroller Lab | 0 | 0 | 2 | 2 | 25 | 50 | 3 | 1 |
| 9 | **MC** | Mandatory Course | - | - | 3 | 3 | 50 | - | 3 | 0 |
| 10 | **PC653EC** | Summer Internship* | - | - | - | - | 50 | - | - | - |
| **Total** | | | **18** | **3** | **7** | **28** | **280** | **520** | | **20** |

**PC**: Professional Course **PE**: Professional Elective **OE**: Open Elective

**HS**: Humanities and Social Science **MC**: Mandatory Course

**L**: Lecture **T**: Tutorial **P**: Practical **D**: Drawing

**CIE:** Continuous Internal Evaluation **SEE**: Semester End Examination (Univ. Exam)

**Note:**

1. Each contact hour is a Clock Hour.
2. The Practical class can be of two and half hour (clock hours) duration as per therequirement of a particular laboratory.
3. *The students have to undergo a summer internship of four week duration after sixth semester and credits will be awarded in seventh semester after evaluation.

| **Professional Elective – I** | | | **Open Elective - I** | | |
|---|---|---|---|---|---|
| **S. No.** | **Course Code** | **Course Title** | **S. No.** | **Course Code** | **Course Title** |
| 1 | PE 671 EC | Digital Image Processing | 1 | OE 632 AE | Automotive Safety & Ergonomics |
| 2 | PE 672 EC | Data Communication and computer networking | 2 | OE601CE | Disaster Management |
| 3 | PE 673EC | Optical Communication | 3 | OE602CE | Geo Spatial Techniques |
| 4 | PE 674 EC | Digital TV Engineering | 4 | OE 601CS | Operating Systems |
| | | | 5 | OE 602CS | OOP using Java |
| | | | 6 | OE601 EC | Principles of Embedded Systems ** |
| | | | 7 | OE602 EC | Digital System Design using Verilog HDL ** |
| | | | 8 | OE601 EE | Reliability Engineering |
| | | | 9 | OE 602 EE | Basics of Power Electronics |
| | | | 10 | OE601 ME | Industrial Robotics |
| | | | 11 | OE602 ME | Material Handling |
| | | | 12 | OE601 LA | Intellectual Property Rights |

| **Mandatory Course** | | |
|---|---|---|
| **S. No.** | **Course Code** | **Course Title** |
| 1 | MC951 SP | Yoga Practice |
| 2 | MC952 SP | National Service Scheme |
| 3 | MC953 SP | Sports |

**Note**: ** Indicates that subject is not offered to the students of Electronics and Communication Engineering Department.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| PC601EC | **DIGITAL COMMUNICATION** | | | | | | Core |
| Prerequisite | Contact Hours per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| PTSP<br>PC 403EC<br>AC<br>PC 502EC | 3 | 1 | - | - | 30 | 70 | 3 |

**Course Objectives:**

1. Familiarize the students with elements of digital communication system and waveform coding techniques like PCM, DPCM, DM and ADM.
2. Introduce the concepts of information theory and source coding
3. Familiarize the students with channel coding techniques such as LBC, BCC and convolution codes
4. Introduce the concepts of baseband digital data transmission and analyze the error performance of different digital carrier modulation schemes like ASK, FSK, PSK etc.
5. Familiarize the students with the concepts of spread spectrum communication with emphasis on DSSS and FHSS

**Course Outcomes:**

1. Classify the different types of digital modulation techniques PCM, DPCM, DM and ADM and compare their performance by SNR.
2. Illustrate the classification of channels and Source coding methods.
3. Distinguish different types of Error control codes along with their encoding/decoding algorithms.
4. Examine the Performance of different Digital Carrier Modulation schemes of Coherent and Non-coherent type based on Probability of error.
5. Generation of PN sequence using Spread Spectrum and characterize the Acquisition Schemes for Receivers to track the signals.

**UNIT – I**

**Elements of Digital Communication System,** Comparison of Digital and Analog Communication Systems, Waveform Coding: Analog to Digital Conversion, Quantization and Encoding techniques, PCM. Companding in PCM systems - u law and A law, Applications of

PCM: Introduction to Linear Prediction Theory. Modulation and demodulation of DPCM, DM and ADM. Comparison of PCM, DPCM, DM and ADM. $SNR_Q$ of PCM and DM

**UNIT – II**

**Information Theory and Source Coding:**Uncertainty, Information and entropy. Source-coding, Shannon – Fano and Huffman coding. Discrete memory less channel – Probability relations in a channel, priori & posteriori entropies, mutual information, Channel capacity - Binary Symmetric Channel, Binary Erasure Channel, , cascaded channels, information rate. Shannon-Hartley Theorem – Shannon Bound.

**UNIT – III**

**Channel Coding:**Types of transmission errors, need for error control coding, Linear Block Codes (LBC): description of LBC, generation, Syndrome and error detection, Minimum distance of Linear block code, error correction and error detection capabilities, Standard array and syndrome decoding, Hamming codes. Binary cyclic codes (BCC): Description of cyclic codes, encoding, decoding and error correction using shift registers. Convolution codes: description, encoding – code tree, state diagram.

**UNIT – IV**

**Introduction to Base band digital data transmission –**block diagram, ISI, eye patternDigital Carrier Modulation Schemes — Description and generation of ASK, FSK, PSK. optimum receiver – matched filter, correlation receiver. Gaussian error probability -Coherent detection of Binary ASK, FSK, PSK. DPSK. Comparison of digital carrier modulation schemes. M-ary signaling schemes – Introduction, QPSK,Synchronization methods.

**UNIT – V**

**Spread Spectrum Communication:** Advantages of Spread Spectrum, generation and characteristics of PN sequences. Direct sequence spread spectrum and Frequency hopping spread spectrum systems and their applications. Acquisition and Tracking of DSSS and FHSS signals.

***Suggested Reading:***

1. Simon Haykin, “Communication systems” 4/e, Wiley India 2011
2. Sam Shanmugam K, “Digital and Analog Communication systems”, Wiley 1979.
3. B.P.Lathi, “Modern digital and analog communication systems” 3/e, Oxford University Press. 1998

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| PC602EC | **ANTENNAS AND WAVE PROPAGATION** | | | | | | Core |
| Prerequisite | Contact Hours per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| EMTL<br>PC 404 EC | 3 | 1 | - | - | 30 | 70 | 3 |

**Course Objectives:**

1. To familiarize the students with the basic principles of antennas and introduce the antenna terminology.
2. To introduce different types of wire antennas and make proficient in analytical skills for understanding practical antennas.
3. To familiarize with the design of different types of antennas for various frequency ranges and latest developments in the practical antennas.
4. To introduce need for antenna arrays and the concepts of measurements of antennas.
5. To introduce the various modes of Radio Wave propagation used.

**Course Outcomes:**

1. To illustrate the basic principles of antennas and learn the antenna terminology.
2. To design different types of wire antennas and make proficient in analytical skills forunderstanding practical antennas.
3. To design different types of antennas for various frequency ranges and get updated with latest developments in the practical antennas.
4. To apply the principles of antennas, to design antenna arrays and measure various parameters of antennas.
5. To Identify and understand the suitable modes of Radio Wave propagation used in current practice

**Unit – I**

Introduction, Fundamental Concepts- Physical concept of radiation, Radiation pattern, Isotropic Radiator, Front–to-back ratio, Antenna Field Regions, Radiation Intensity, Beam Area, Beam Efficiency, Reciprocity, Directivity and Gain, Antenna Apertures, Antenna Polarization, Antenna impedance, Antenna temperature, Friis transmission equation, Retarded potential.

**Unit – II**

Current Distributions, Radiation from Infinitesimal Dipole, Half wave Dipole and Quarter wave Monopole, Loop Antennas - Introduction, Small Loop, Far field pattern of circular loop with uniform current, Comparison of far fields of small loop and short dipole, Slot Antennas, Helical Antennas-Helical Geometry, Helix modes, Practical Design considerations for Monofilar Helical Antenna in Axial and Normal Modes, wideband characteristics, radiation efficiency.

**Unit – III**

V-antenna, Rhombic Antenna, Yagi-Uda Antenna, Folded Dipoles & their Characteristics, Log-periodic Antenna, Aperture Antennas- Huygens' principle, Radiation from apertures, Babinet's principle, Radiation from Horns and design considerations, Parabolic Reflector and cassegrain Antennas, Lens Antennas, Micro Strip Antennas- Basic characteristics, feeding Methods, Design of Rectangular Patch Antennas, Smart Antennas- Fixed weight Beam Forming basics and Adaptive Beamforming,

**Unit – IV**

Array of point sources, two element array with equal and unequal amplitudes, different phases, linear n- element array with uniform distribution, Broadside and End fire arrays, Principle of Pattern Multiplication, Effect of inter element phase shift on beam scanning, Binomial array, Synthesis of Antenna arrays using Schelkunoff Polynomial method, Woodward-Lawson method.

**Antenna Measurements:** Introduction, Antenna Test Site and sources of errors, Radiation Hazards, Patterns to be Measured, Radiation, Gain and Impedance Measurement Techniques.

**Unit – V**

Ground wave propagation, Space and Surface waves, Troposphere refraction and reflection, Duct propagation, Sky wave propagation, Regular and irregular variations in ionosphere. Line of sight propagation.

***Suggested Reading:***

1. J. D. Kraus, R. J. Marhefka & Ahmad S. Khan, "Antennas and wave Propagation", McGraw-Hill, 4rth Edition, 2010.
2. Constantine A. Balanis, "Antenna Theory: Analysis and Design", Wiley, 3rd edition, 2005
3. Edward C. Jordan and Kenneth G. Balmain, “Electromagnetic Waves and Radiating Systems,” 2/e, PHI, 2001

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| PC603EC | **MICROPROCESSOR AND MICROCONTROLLER** | | | | | | core |
| Prerequisite | Contact Hours per Week:4 | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| COA<br>PC505EC<br>STLD<br>PC304EC | 3 | 1 | - | - | 30 | 70 | 3 |

**Course objectives:**

1. Understand architecture & programming of 8086 microprocessor and 8051 microcontrollers.
2. Design Interfacing of memory , 8255,8257 and 8251 to 8086 processor
3. Differentiation of 8086 and 8051 in terms of internal architecture, memory, programming.
4. Design Interfacing & Programming of I/O ports, timers and UART using 8051.
5. Design Interfacing of real time devices like ADC, DAC and stepper motor with 8051.

**Course Outcomes:**

1. Explain the architecture of 8086 microprocessor and recognize different types of addressing modes.
2. Write assembly language programming using 8086 microprocessor instruction set.
3. Interface different peripherals to 8086 microprocessor.
4. Explain the architecture of 8051 architecture and write Assembly/C language programming using 8051 microcontroller.
5. Interface different peripherals to 8051 microcontroller.

**UNIT-I:**

Intel 8086/8088 architecture, Segmented memory, Minimum and Maximum modes of operation, Timing diagram, addressing modes, Instruction set, assembly language programming using data transfer, arithmetic, logical and branching instructions

**UNIT-II:**

Assembler directives, macros, procedures,assembly language programming using string manipulation instructions, 8086 Interrupt structure, IO and Memory Interfacing concepts using 8086, IC Chip Peripherals-8255 PPI, 8257 DMA controller, 8251 USART

**Unit-III:**

**8051 Microcontroller** – Internal architecture and pin configuration, 8051 addressing modes, instruction set, Bit addressable features. I/O Port structures, assembly language programming using data transfer, arithmetic, logical and branch instructions.

**UNIT IV:**

8051 Timers/Counters, Serial data communication and its programming, 8051 interrupts, Interrupt vector table, Interrupt programming.

**UNIT V:**

Interfacing of 8051 with LCD, ADC, DAC, external memory, Stepper Motor interfacing.

***Suggested Reading:***

1. Ray A.K &Bhurchandhi K.M, "Advanced Microprocessor and Peripherals," 2/e, TMH, 2007.
2. Mazidi M.A, Mazidi J.G &Rolin D. Mckinlay, "The 8051 Microcontroller & Embedded Systems using Assembly and C," 2/e, Pearson Education, 2007
3. Ayala K.J, "The 8051 Micro Controller Architecture, programming and Application," Penram International, 2007.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| HS604EC | **MANAGERIAL ECONOMICS AND ACCOUNTANCY** | | | | | | Core |
| Prerequisite | Contact Hours per Week:2 | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| - | 3 | - | - | - | 30 | 70 | 3 |

**Course objectives:**

1. To learn important concepts of Managerial Economics and apply them to evaluate business decisions.
2. To understand various parameters that determines the consumers' behavior.
3. To evaluate the factors that affect production.
4. To understand the concepts of capital budgeting and payback period.
5. To study the concepts of various book-keeping methods.

**Course Outcomes:**

1. Apply the fundamental concepts of managerial economics to evaluate business decisions.
2. Understand types of Demand and factors related to it.
3. Identify different types of markets and determine price –output under perfect competition.
4. Determine working capital requirement and payback period.
5. Analyze and interpret financial statements through ratios.

**UNIT – I**

**Meaning and Nature of Managerial Economics**: Managerial Economics and its usefulness to Engineers, Fundamental Concepts of Managerial Economics-Scarcity, Marginalism, Equimarginalism, Opportunity costs, Discounting, Time Perspective, Risk and Uncertainty, Profits, Case study method.

**UNIT – II**

**Consumer Behavior:** Law of Demand, Determinants, Types of Demand; Elasticity of Demand (Price, Income and Cross-Elasticity); Demand Forecasting, Law of Supply and Concept of Equilibrium. (Theory questions and small numerical problem can be asked).

**UNIT – III**

**Theory of Production and Markets:** Production Function, Law of Variable Proportion, ISO quants, Economics of Scale, Cost of Production (Types and their measurement), Concept of Opportunity Cost, Concept of Revenue, Cost-Output relationship, Break-Even Analysis, Price - Output determination under Perfect Competition and Monopoly (theory and problems can be asked).

**UNIT – IV**

**Capital Management**: Significance, determination and estimation of fixed and working capital requirements, sources of capital, Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems. (Theory questions and numerical problems on estimating working capital requirements and evaluation of capital budgeting opportunities can be asked).

**UNIT – V**

**Book-keeping**: Principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance, concept and preparation of Final Accounts with simple adjustments, Analysis and interpretation of Financial Statements through Ratios.
(Theory questions and numerical problems on preparation of final accounts, cash book, and petty cash book, bank reconciliation statement, calculation of some ratios).

***Suggested Readings****:*

1. Mehta P.L., Managerial Economics —Analysis, Problems and Cases , Sulthan Chand & Sons Educational Publishers, 2011.
2. Maheswari S.N., Introduction to Accountancy , Vikas Publishing House, 2005.
3. Pandey I.M., Financial Management , Vikas Publishing House, 2009.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| PC651EC | **COMMUNICATION LAB** | | | | | | Core |
| Prerequisite | Contact Hours per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| AC (PC 502 EC)<br>DC (PC603EC) | - | - | - | 2 | 25 | 50 | 1 |

**Course Objectives:**

1. Demonstrate AM, FM, Mixer, PAM, PWM and PPM techniques.
2. Understand multiplexing techniques.
3. Understand and simulate digital modulation (i.e., ASK, FSK, BPSK, QPSK) generation and detection.
4. Model analog, pulse modulation, PCM, Delta and Digital modulation techniques using CAD tools
5. Obtain data formats.

**Course Outcomes:**

1. Understand and simulate modulation and demodulation of AM and FM.
2. Construct pre-emphasis and de-emphasis at the transmitter and receiver respectively
3. Understand and simulate the PAM,PWM&PPM circuits
4. Understand baseband transmission (i.e., PCM, DPCM, DM, and ADM) generation and detection.
5. Understand error detection and correction.
6. Obtain modem characteristics.

## PART-A

1. AM generation and detection
2. FM generation and detection
3. Pre emphasis and De-emphasis circuits
4. Multiplexing Techniques (FDM and TDM)
5. Mixer Characteristics
6. Sampling , PAM, PWM, and PPM generation and detection
7. Generation and Detection of Analog and Pulse modulation techniques by usingMATLAB/Simulink/Labview

## PART-B

1. PCM generation and detection
2. Data formats / channel encoding and decoding.
3. Linear and Adaptive Delta Modulation and Demodulation
4. Modem characteristics.
5. ASK generation and Detection.
6. FSK and Minimum Shift Keying generation and Detection.
7. Phase shift keying methods (BPSK, QPSK) generation and Detection.
8. Generation and Detection of PCM, Delta modulation and Digital modulation Schemes (ASK. FSK, BPSK, QPSK) by using MATLAB/Simulink/Lab-view.

**General Note:** At least 12 experiments are to be conducted.

| Course Code | Course Title | | | | Core/Elective | | |
|---|---|---|---|---|---|---|---|
| PC652EC | **MICROPROCESSOR AND MICROCONTROLLER LAB** | | | | Core | | |
| Prerequisite | Contact Hours per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| MPMC PC 603 EC | - | - | - | 2 | 25 | 50 | 1 |

**Course objectives:**

1. Apply Assembly language programs on 8086 trainer kit in standalone/serial mode
2. Classify interface modules into input /output and Memory interfaces with 8086
3. Develop and execute the embedded C programming concepts of 8051 microcontroller.
4. Design and develop 8051embedded C programs for various interface modules.
5. Develop Interface with serial and I2C bus.

**Course Outcomes:**

1. Apply different addressing modes & Model programs using 8086 Instruction set
2. Explain the usage of string instructions of 8086 for string manipulation, Comparison
3. Develop interfacing applications using 8086 processor
4. Design different programs using C cross compilers for 8051 controller
5. Develop interfacing applications using 8051 controller

## PART- A

1. Use of 8086 trainer kit and execution of programs. (Instruction set for simple Programs using 4 to 5 lines of instruction code under different addressing modes for data transfer, manipulation, Arithmetic operations)
2. Branching operations and logical operations in a given data.
3. Multiplication and division.
4. Single byte, multi byte Binary and BCD addition and subtraction
5. Code conversions.
6. String Searching and Sorting.
7. Interface a stepper motor to 8086 using 8255 PPI
8. Interface a USART 8251 to 8086 for serial data transfer/Receive

## PART–B

**[Experiments for 8051 using any C- Cross Compiler & appropriate hardware]**

1. Familiarity and use of 8051/8031 Microcontroller trainer, and execution of programs.
2. Instruction set for simple Programs (using 4 to 5 lines of instruction code).
3. Timer and counter operations & programming using 8051.
4. Serial communications using UART
5. Programming using interrupts
6. Interfacing 8051 with DAC to generate waveforms.
7. Interfacing traffic signal control using 8051.
8. Program to control stepper motor using 8051.
9. ADC interfacing with 8051
10. Serial RTC interfacing with 8051
11. LCD interfacing with 8051

**Note:**

1. Preliminary explanation of the features and use of the tools must be made in 2/3 theory periods.
2. A total of not less than 12 experiments must be carried out during the semester with at least 6 from each part.

***Suggested Reading:***

1. Myke Predko – *Programming and Customizing the 8051 Microcontroller*, TMH,2005
2. Mazidi M.A, Mazidi J.G &Rolin D. Mckinlay, "The 8051 Microcontroller & Embedded Systems using Assembly and C," 2/e, Pearson Education, 2007

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| PC653EC | **SUMMER INTERNSHIP** | | | | | | Core |
| Prerequisite | Contact Hours per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| - | - | - | - | 2 | 50 | - | 2* |

**Course Objectives:**

1. To give an experience to the students in solving real life practical problems with all itsconstraints.
2. To give an opportunity to integrate different aspects of learning with reference to real lifeproblems.
3. To enhance the confidence of the students while communicating with industry engineers.
4. Give an opportunity for useful interaction with them and familiarize with work culture andethics of the industry.

**Course Outcomes:**

Student will be

1. Able to design/develop a small and simple product in hardware or software.
2. Able to complete the task or realize a pre-specified target, with limited scope, rather thantaking up a complex task and leave it.
3. Able to learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to pre-specified criteria.
4. Able to implement the selected solution and document the same.

Summer Internship is introduced as part of the curricula for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from an Electronics Industry / R & D Organization / National Laboratory / any other program approved by the department in consultation with the Chair, BOS and the same be informed to the Dean, Faculty of Engineering, for a period of four weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide.

After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department. Award of sessional are to be based on the performance of the student at the work place to be judged by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will coordinate the overall activity of Summer Internship.

**Note:** *Students have to undergo summer internship of fourweeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester.

# PROFESSIONAL ELECTIVE-I

| Course Code | CourseTitle | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| PE 671 EC | **DIGITAL IMAGE PROCESSING** | | | | | | Elective |
| Prerequisite | Contact Hours per Week: | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| DSP<br>PC 503 EC | 3 | - | - | - | 30 | 70 | 3 |

**Course Objectives:**

1. To provide an introduction to the basic concepts and methodologies for Digital Image processing.
2. To familiar with spatial and transform domain techniques used in Image Enhancement, Restoration and Segmentation of Images.
3. To gain knowledge about various Image transforms used in Image processing and Image compression problems.
4. To understand various methods employed for edge , line and isolated points detection in an image.

**Course Outcomes:**

Student will be

1. Able to develop a foundation that can be used as the basis for higher study and research in the Image processing area.
2. Able to design various filters for processing and deblurring of images without destroying fine details like edges and lines.
3. Able to apply image processing techniques for processing and analysis of remotely sensed,Microscope, Radar and Medical images.
4. Able to understand the need for Digital Image processing techniques for Machine vision applications and concept of image compression.

**UNIT – I**

**Digital Image Fundamentals**: Image sensing, acquisition, Image formation model, sampling andQuantization, Basic relationships between pixels; neighbors of a pixel, adjacency, connectivity, regions and boundaries. Image formation, brightness, adaptation and discrimination. Categorization of images according to their source of EM radiation.

**UNIT – II**

**Image Transforms**: 2D Fourier transform, Properties of 2D Fourier transform, Walsh, Hadamard,Slant, Haar, Discrete cosine transform and Hotelling transform.

**UNIT – III**

**Image Enhancement**: Spatial domain techniques: Contrast stretching, histogram equalization andhistogram specification method, Neighborhood averaging and adaptive Median filter. Frequency domain methods: Ideal Low pass, Butterworth and Gaussian Lowpass filters. Ideal Highpass, Butterworth and Gaussian Highpass filters. Homomorphic filtering.

**UNIT – IV**

**Image Restoration**: Mathematical expression for degraded image, estimation of degradationfunctions: image observation, experimentation and by modeling, Inverse filter, Wiener filter, Geometric transformation, periodic noise reduction method.

**UNIT – V**

**Image segmentation and Compression**: Detection of discontinuities, point lineAnd Edge detection methods: Gradient operation, Laplacian, Prewitt, Sobel, Laplacian of a Gaussian and Canny edge detectors. Image compression: Functional block diagram of a general image compression system various types of redundancies, Huffman coding, , Arithmetic coding.

***Suggested Readings:***

1. Rafeal C.Gonzalez, Richars E.Woods , *Digital Image Processing* ", Pearsons Education, 2009, 3rd Edition.
2. Anil K Jain, *Fundamentals of Digital Image Processing*, Prentice-Hall of India Private Limited, New Delhi, 1995.
3. Milan Sonka, Vaclav Havel and Roger Boyle, *Digital Image Processing and Computervision*, Cengage Learning India Pvt. Limited, 2008.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| PE 672 EC | **DATA COMMUNICATION AND COMPUTER NETWORKING** | | | | | | Elective |
| Prerequisite | Contact Hours per Week: | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| AC PC 502EC | 3 | - | - | - | 30 | 70 | 3 |

**Course Objectives:**

1. To provide a conceptual foundation for the study of data communications using the open Systems interconnect (OSI) model for layered architecture.
2. To study the principles of network protocols and internetworking
3. To understand the Network security and Internet applications.
4. To understand the concepts of switched communication networks.
5. To understand the performance of data link layer protocols for error and flow control.
6. To understand various routing protocols and network security.

**Course Outcomes:**

1. Understand the working of various network topologies and circuit and packet switching
2. Comprehend the role of data link layers and significance of MAC protocols
3. Understand the networking protocols and Internet protocols
4. Understand the transport layer working with TCP, UDP and ATM protocols
5. Comprehend the functionality of application layer and importance of network security.

**UNIT-I**

**Data communication:** A Communication Model, The Need for Protocol Architecture and Standardization, Network Types: LAN, WAN, MAN. Network Topologies: Bus, Star, Ring, Hybrid. Line configurations. Reference Models: OSI, TCP/IP.

**Circuit switching:** Circuit Switching Principles and concepts.
**Packet switching:** Virtual circuit and Datagram subnets, X.25.

**UNIT-II**

**Data Link Layer:** Need for Data Link Control, Design issues, Framing, Error Detection and Correction, Flow control Protocols: Stop and Wait, Sliding Window, ARQ Protocols, HDLC.

**MAC Sub Layer:** Multiple Access Protocols: ALOHA, CSMA, Wireless LAN. IEEE 802.2, 802.3, 802.4,802.11,802.15, 802.16 standards. Bridges and Routers.

**UNIT-III**

**Network Layer:** Network layer Services, Routing algorithms : Shortest Path Routing, Flooding, Hierarchical routing, Broadcast, Multicast, Distance Vector Routing, and Congestion Control Algorithms.

**Internet Working:** The Network Layer in Internet :IPV4, IPV6, Comparison of IPV4 and IPV6, IP Addressing, ATM Networks.

**UNIT-IV**

**Transport Layer:** Transport Services, Elements of Transport Layer, Connection management, TCP and UDP protocols, ATM AAL Layer Protocol.

**UNIT-V**

**Application Layer:** Domain Name System, SNMP, Electronic Mail, World Wide Web.

**Network Security:** Cryptography Symmetric Key and Public Key algorithms, Digital Signatures, Authentication Protocols.

***Suggested Reading:***

1. Andrew S Tanenbaum, "Computer Networks," 5/e, Pearson Education, 2011.
2. Behrouz A. Forouzan, "Data Communication and Networking,"3/e, TMH, 2008.
3. William Stallings, "Data and Computer Communications," 8/e, PHI, 2004.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| PE 673EC | **OPTICAL COMMUNICATION** | | | | | | Elective |
| Prerequisite | Contact Hours per Week: | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| DC<br>PC 601EC | 3 | - | - | - | 30 | 70 | 3 |

**Course Objectives:**

1. Learn concepts of propagation through optical fibermodes and configurations, Losses and dispersion through optical fiber.
2. Understand operating principles of light sources and detectors used in optical transmitters and Receivers.
3. Design an optical link in view of loss and dispersion.

**Course Outcomes:**

1. Study of modes of optical communication through optical waveguides
2. Analyze the losses inserted in an optical fibre
3. Study of material used and underlying principles of optical signal generation
4. Design of optical detection systems
5. Design an optical link in view of loss and dispersion.

**UNIT-I**

Evolution of fiber optic system, Elements of Optical Fiber Transmission link, Ray Optics, Optical Fiber Modes and Configurations, Mode theory of Circular Waveguides, Overview Low frequency data transportation of Modes and Key concepts, Linearly Polarized Modes, Single Mode Fibers and Graded Index fiber structure.

**UNIT-II**

Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Waveguides-Information Capacity determination, Group Delay, Material Dispersion, Waveguide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in Guided Index fibers, Mode Coupling, Types of OFC Connectors and issues involved Design Optimization of Single and cut-off wavelength.

**UNIT-III**

Direct and indirect Band gap materials, LED structures, Light source materials, Quantum efficiency, LED power, Modulation of LED, laser Diodes, Modes and Threshold condition, Rate equations, External Quantum efficiency, Resonant frequencies, Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers, Power Launching and coupling, Lensing schemes, Fiber-to-Fiber joints, Fiber splicing.

**UNIT-IV**

PIN and APD diodes, Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise, Comparison of Photo detectors, Fundamental Receiver Operation, preamplifiers, Error Sources, Receiver Configuration, Probability of Error, Quantum Limit.

**UNIT-V**

Point-to-Point link system considerations -Link Power budget, Rise - time budget, Noise Effects on System Performance, Operational Principles of WDM and Applications. Erbium-doped Amplifiers. Introductory concepts of SONET/SDH Network. Multiple signal interface in fibers, Bandwidth utilization, Interface with nano-electronic devices.

***Suggested Reading:***

1. Gourd Keiser, *"Optical Fiber Communication,"* 4/e, TMH, 2000.
2. J.Senior, *"Optical Communication, Principles and Practice,"* PHI, 1994.
3. J.Gower, *"Optical Communication System,"* PHI, 2001.
4. Binh, *"Digital Optical Communications,"* First Indian Reprint 2013, (Taylor & Francis), Yesdee Publications.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| PE 674 EC | **DIGITAL TV ENGINEERING** | | | | | | Elective |
| Prerequisite | Contact Hours per Week: | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| AEC PC401EC | 3 | - | - | - | 30 | 70 | 3 |

**Course objectives:**

1. Study the different camera and picture tubes.
2. Know about various standard TV channels.
3. Study about TV receiver, sync separation, detector etc.,
4. Study about color signal encoding, decoding and receiver.

**Course Outcomes:**

1. Study the types of camera tubes and signal transmission and propagation
2. Analyze the TV receiver circuits for audio and video detection.
3. Study of TV tuning circuits and separation of audio and video signals
4. Understand the fundamentals of color television and colour signal transmission.
5. Study of color receiver and tuning circuits.

**UNIT–I:**

**Introduction:** TV transmitter and receivers, synchronization. Geometric form and aspect ratio, image continuity, interlaced scanning, picture resolution, Composite video signal, TV standards. Camera tubes: image Orthicon, Plumbicon, vidicon, silicon Diode Array vidicon, Comparison of camera tubes, Monochrome TV camera, TV Signal Transmission and Propagation: Picture Signal transmission, positive and negative modulation, VSB transmission, sound signal transmission, standard channel BW,TV transmitter, TV signal propagation, interference, TV broadcast channels, TV transmission Antennas.

**UNIT –II:**

**Monochrome TV Receiver:** RF tuner, IF subsystem, video amplifier, sound section, sync separation and processing, deflection circuits, scanning circuits, AGC, noise cancellation, video and inter carrier sound signal detection, vision IF subsystem of Black and White receivers, Receiver sound system: FM detection, FM Sound detectors, and typical applications.

**UNIT –III:**

**Sync Separation and Detection:** TV Receiver Tuners, Tuner operation, VHF and UHF tuners, digital tuning techniques, remote control of receiver functions. Sync Separation, AFC and Deflection Oscillators: Synchronous separation, k noise in sync pulses, separation of frame and line sync pulses. AFC, single ended AFC circuit, Deflection Oscillators, deflection drive Ics, Receiver Antennas, Picture Tubes.

**UNIT–IV:**

**Color Television:** Colour signal generation, additive colour mixing, video signals for colours, colour difference signals, encoding, Perception of brightness and colours luminance signal, Encoding of colour difference signals, formation of chrominance signals, color cameras, Colour picture tubes. Color Signal Encoding and Decoding: NTSC colour system PAL colour system, PAL encoder, PAL-D Decoder, chrome signal amplifiers, separation of U and V signals, colour burst separation, Burst phase discriminator, ACC amplifier, Reference oscillator, Indent and colour killer circuits, U& V demodulators.

**UNIT –V:**

**Color Receiver:** Introduction to colour receiver, Electron tuners, IF subsystem, Y-signal channel, Chroma decoder, Separation of U & V Color, Phasors, synchronous demodulators, Sub carrier generation, raster circuits.
**Digital TV:** Introduction to Digital TV, Digital Satellite TV, Direct to Home Satellite TV, Digital TV Transmitter, Digital TV Receiver, Digital Terrestrial TV, LCD TV, LED TV, CCD Image Sensors, HDTV.

***Suggested Reading:***

1. Television and Video Engineering- A.M.Dhake, 2nd Edition.
2. Modern Television Practice – Principles, Technology and Service- R.R.Gallatin, New Age International Publication, 2002.
3. Monochrome and Colour TV- R.R. Gulati, New Age International Publication, 2002.

# OPEN ELECTIVE-I

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| OE 601 EC | **PRINCIPLES OFEMBEDDED SYSTEMS** | | | | | | Elective |
| Prerequisite | Contact Hours per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| Basic Electronics | 3 | - | - | - | 30 | 70 | 3 |

**Course objectives:**

1. To understand the fundamentals of embedded systems.
2. To study the block diagram and advanced hardware fundamentals.
3. To study the software architecture of embedded systems.
4. To learn the tool chain of embedded systems.
5. To understand the tools and debugging process of embedded systems.

**Course Outcomes:**

Student will be

1. Able to acquire an overview of what an embedded system implies.
2. Able to understand the architecture of a microprocessor and microcontroller to enable to design embedded applications using them.
3. Able to apply theoretical learning to practical real time problems for automation.
4. Able to understand how to build and debug an embedded system application.
5. Able to analyze and design real world applications and interface peripheral devices to the microprocessor

**UNIT – I**

**Fundamentals of embedded systems:** Definition of Embedded system, Examples of EmbeddedSystems, Typical Hardware, Terminology, Gates, A few other basic considerations, Timing Diagrams, Memory.

**UNIT – II**

**Advanced hardware fundamentals:** Microprocessors, Buses, Direct Memory Access, Interrupts,Other Common Parts, Built-Ins on the Microprocessor, Conventions used in Schematics, Microprocessor Architecture, Interrupts Basics, Shared Data Problem, Interrupt Latency.

**UNIT – III**

**Software architecture of embedded systems:** Round- Robin, Round-Robin with Interrupts,Function- Queue- Scheduling Architecture, Real- Time Operating System Architecture, Selecting Architecture.

**UNIT – IV**

**Embedded software development tools:** Host and Target Machines, Cross compilers, CrossAssemblers and Tool Chains, Linkers /Locaters for Embedded Software, Getting Embedded Software into Target System: PROM programmers, ROM Emulators, In-Circuit Emulators.

**UNIT – V**

**Debugging techniques:** Testing on your host machine, Instruction Set Simulators, The assertMacro, Using Laboratory Tools.

***Suggested Readings:***

1. David. E. Simon, "*An Embedded Software Primer*", Low price edition, PearsonEducation, New Delhi, 2006.
2. Frank Vahid and Tony Givargis "*Embedded System Design: A UnifiedHardware/Software.Approach*". John Wiley & Sons, October 2001.
3. Rajkamal, "*Embedded systems: Programming, architecture and Design*", second edition, McGraw-Hill Education (India), March 2009.

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>Core/Elective</td></tr>
<tr><td>OE 602 EC</td><td colspan="6">DIGITAL DESIGN USING VERILOG HDL</td><td>Elective</td></tr>
<tr><td rowspan="2">Prerequisite</td><td colspan="4" rowspan="2">Contact Hours per Week</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td><td rowspan="2">Credits</td></tr>
<tr><td rowspan="2">Basic Electronics</td><td>L</td><td>T</td><td>D</td><td>P</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>-</td><td>30</td><td>70</td><td>3</td></tr>
</table>

**Course Objectives:**

1. Describe Verilog hardware description languages (HDL).
2. Develop Verilog HDL code for combinational digital circuits.
3. Develop Verilog HDL code for sequential digital circuits..
4. Develop Verilog HDL code for digital circuits using switch level modeling and describes system tasks, functions and compiler directives
5. Describes designing with FPGA and CPLD.

**Course Outcomes:**

After completion of this course, students should be able to:

1. Understand syntax of various commands, data types and operators available with verilog HDL
2. To design and simulate combinational circuits in verilog
3. To design and simulate sequential and concurrent techniques in verilog
4. Write Switch level models of digital circuits
5. Implement models on FPGAs and CPLDs.

**Unit I**

Introduction to Verilog HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, Module, Simulation and Synthesis Tools

Verilog Data types and Operators, Binary data manipulation, Combinational and Sequential logic design, Structural Models of Combinational Logic, Logic Simulation, Design Verification and Test Methodology, Propagation Delay, Truth Table models using Verilog.

**Unit II**

Combinational Logic Circuit Design using Verilog: Combinational circuits building blocks: Multiplexers, Decoders , Encoders , Code converters, Arithmetic comparison circuits , Verilog for combinational circuits , Adders-Half Adder, Full Adder, Ripple-Carry Adder, Carry Lookahead Adder, Subtraction, Multiplication.

**Unit III**

Sequential Logic Circuit Design using Verilog: Flip-flops, registers & counters, synchronous sequential circuits: Basic design steps, Mealy State model, Design of FSM using CAD tools, Serial Adder Example, State Minimization, Design of Counter using sequential Circuit approach.

**Unit IV**

Switch Level Modeling: Basic Transistor Switches, CMOS Switches, Bidirectional Gates, Time Delays with Switch Primitives, Instantiation with Strengths and Delays, Strength Contention with Trireg Nets.
System Tasks, Functions and Compiler Directives: Parameters, Path Delays, Module Parameters. System Tasks and Functions, File Based Tasks and Functions, Computer Directives, Hierarchical Access, User Defined Primitives.

**Unit V**

Designing with FPGAs and CPLDs: Simple PLDs,ComplexPLDs,Xilinx 3000 Series FPGAs, Designing with FPGAs, Using a One-Hot State Assignment, Altera Complex Programmable Logic Devices (CPLDs), Altera FLEX 10K Series CPLDs.

***Suggested Reading:***

1. T.R. Padmanabhan, B Bala Tripura Sundari, *Design Through Verilog HDL*, Wiley 2009.
2. Samir Palnitkar, *Verilog HDL*, 2nd Edition, Pearson Education, 2009.
3. Stephen Brown, Zvonko Vranesic , *Fundamentals of Digital Logic with Verilog Design* -, TMH, 2nd Edition 2003.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| MC 951 SP | **YOGA PRACTICE** | | | | | | Core |
| Prerequisite | Contact Hours per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| - | - | - | - | 3 | 50 | - | 0 |

**Course Objectives:**

1. Enhances body flexibility.
2. Achieves mental balance.
3. Elevates Mind and Body co-ordination.
4. Precise time management.
5. Improves positive thinking at the expense of negative thinking.

**Course Outcomes:**

Student will

1. Become more focused towards becoming excellent citizens with more and more discipline in their day-to-day life.
2. An all-round development-physical, mental and spiritual health-takes place.
3. Self-discipline and discipline with respect society enormously increases.
4. University environment becomes more peaceful and harmonious.

**UNIT-I**

**Introduction:** Yoga definition-Health definition from WHO - Yoga versus Health - Basis of Yoga - yoga is beyond science- Zist of 18 chapters of Bhagavadgita - 4 types of yoga: Karma, Bhakti, Gnyana and Raja yoga – Internal and External yoga - Elements of Ashtanga yoga (Yama, Niyama, Asana, Pranayama, Prathyahara, Dharana, Dhyana and Samadhi) - Pancha koshas and their purification through Asana, Pranayama and Dhyana.

**UNIT-II**

**Suryanamaskaras (Sun Salutations):** Definition of sun salutations - 7 chakras (Mooladhaar, Swadhishtaan, Manipura, Anahata, Vishuddhi, Agnya and Sahasrar) - Vaious manthras (Om Mitraya, Om Ravaye, Om Suryaya, Om Bhanave, Om Marichaye, Om Khagaye, Om Pushne, Om Hiranya Garbhaye, Om Adhityaya, Om Savitre, Om Arkhaya, and Om Bhaskaraya) and their meaning while performing sun salutations - Physiology - 7 systems of human anatomy - Significance of performing sun salutations.

**UNIT-III**

**Asanas (Postures):** Pathanjali's definition of asana - Sthiram Sukham Asanam - 3rd limb of Ashtanga yoga - Loosening or warming up exercises - Sequence of perform in asanas (Standing, Sitting, Prone, Supine and Inverted) - Nomenclature of asanas (animals, trees, rishis etc) - Asanas versus Chakras - Asanas versus systems - Asanas versus physical health -Activation of Annamaya kosha.

**UNIT-IV**

**Pranayama (Breathing Techniques):** Definition of Pranayama as per Shankaracharya - 4th limb of Ashtanga yoga - Various techniques of breathing - Pranayama techniques versus seasons - Bandhas and their significance in Pranayama - Mudras and their significance in Pranayama - Restrictions of applying bandhas with reference to health disorders - Pranayama versus concentration - Pranayama is the bridge between mind and body - Pranayam versus mental health - Activation of Pranamaya kosha through Pranayama.

**UNIT-V**

**Dhyana (Meditation):** Definition of meditation - 7th limb of Ashtanga yoga - Types of mind (Conscious and Sub-Conscious) - various types of dhyana. Meditation versus spiritual health - Dharana and Dhyana - Extention of Dhyana to Samadhi - Dhyana and mental stress - Activation of Manomaya kosha through dhyana - Silencing the mind.

***Suggested Reading:***

1. Light on Yoga by BKS lyengar.
2. Yoga education for children Vol-1 by Swami Satyananda Saraswati.
3. Light on Pranayama by BKS lyengar.
4. Asana Pranayama Mudra and Bandha by Swami Satyananda Saraswati.
5. Hatha Yoga Pradipika by Swami Mukhtibodhananda.
6. Yoga education for children Vol-11 by Swami Niranjanananda Saraswati.
7. Dynamics of yoga by Swami Satyananda Saraswati.

**Evaluation Process:**

Total Marks: 50 marks for continuous evaluation

a) 15 marks for viva voce.

b) 35 marks for activities and exam

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>Core/Elective</td></tr>
<tr><td>MC 952 SP</td><td colspan="6">NATIONAL SERVICE SCHEME (NSS)</td><td>Core</td></tr>
<tr><td rowspan="2">Prerequisite</td><td colspan="4">Contact Hours per Week</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td><td rowspan="2">Credits</td></tr>
<tr><td rowspan="2">-</td><td>L</td><td>T</td><td>D</td><td>P</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>3</td><td>50</td><td>-</td><td>0</td></tr>
<tr><td colspan="7">Course Objectives:<br>1. To help in Character Moulding of students for the benefit of society.<br>2. To create awareness among students on various career options in different fields.<br>3. To remould the students behaviour with assertive skills and positive attitudes.<br>4. To aid students in developing skills like communication, personality, writing and soft skills.<br>5. To educate students towards importance of national integration, participating in electoral process etc by making them to participate in observing important days.</td></tr>
</table>

**List of Activities:**

1. Orientation programme about the role of NSS in societal development
2. Swachh Bharath Programme
3. Guest lecture's from eminent personalities on personality development
4. Plantation of saplings/Haritha Haram Programme
5. Blood Donation / Blood Grouping Camp
6. Imparting computer education to school children
7. Creating Awareness among students on the importance of Digital transactions
8. Stress management techniques
9. Health Checkup Activities
10. Observation of Important days like voters day, World Water Day etc.
11. Road Safety Awareness Programs
12. Energy Conservation Activities

13. Conducting Programme's on effective communication skills
14. Awareness programme's on national integration
15. Orientation on Improving Entrepreneurial Skills

16. Developing Effective Leadership skills
17. Job opportunity awareness programs in various defence, public sector undertakings
18. Skill Development Programmes
19. Creating awareness among students on the Importance of Yoga and other physical activities
20. Creating awareness among students on various government sponsored social welfare schemes for the people.

**Note:**At least Ten Activities should be conducted in the Semester**.**Each event conducted under swachh bharath, Plantation and important days like voters day, world water day may be treated as a separate activity.

**Evaluation Process:**

Total Marks: 50 marks for continuous evaluation

a) 15 marks for viva voce.
b) 35 marks for activities and exam

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>Core/Elective</td></tr>
<tr><td>MC 953 SP</td><td colspan="6">SPORTS</td><td>Core</td></tr>
<tr><td rowspan="2">Prerequisite</td><td colspan="4">Contact Hours per Week</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td><td rowspan="2">Credits</td></tr>
<tr><td rowspan="2">-</td><td>L</td><td>T</td><td>D</td><td>P</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>3</td><td>50</td><td>-</td><td>0</td></tr>
</table>

**Course Objectives:**

1. To develop an understanding of the importance of sport in the pursuit of a healthy and activelifestyle at the College and beyond.
2. To develop an appreciation of the concepts of fair play, honest competition and good sportsmanship.
3. To develop leadership skills and foster qualities of co-operation, tolerance, consideration, trust and responsibility when faced with group and team problem-solving tasks.
4. To develop the capacity to maintain interest in a sport or sports and to persevere in order to achieve success.
5. To prepare each student to be able to participate fully in the competitive, recreational and leisure opportunities offered outside the school environment.

**Course Outcomes:**

Student will be

1. Students' sports activities are an essential aspect of university education, one of the most efficient means to develop one's character and personal qualities, promote the fair game principles, and form an active life position.
2. Over the past year, sports have become much more popular among our students. Let us remember the most memorable events related to sports and physical training.
3. Special attention was paid to team sports. Our male and female games and sports have achieved remarkable progress at a number of competitions.
4. Our teams in the main sports took part in regional and national competitions. Special thanks to our team in track and field athletics, which has been revitalized this year at ICT and which has won Javelin competition.
5. Staff of our faculties and students of Sports, Physical Development, & Healthy Lifestyle of Faculty congratulates everyone on the upcoming New Year and wishes

you robust health and new victories in whatever you conceive.

**Requirements:**

i)Track Pants (students should bring)
ii)Shoes
iii)Cricket, Volley Ball, Foot Ball, Badminton (Shuttle) etc.
iv) Ground, Court, indoor stadium, swimming pool etc.

**Evaluation Process:**

**Total Marks**: 50 marks for continuous evaluation

a) 15 marks for viva voce.
b) 35 marks for activities and exam