| | | Third Semester | | | |
|---|---|---|---|---|---|
| Group | Paper Code | Paper | L | P | Credits |
| Theory Papers | | | | | |
| ES | ES-201 | Computational Methods | 4 | | 4 |
| HS/MS | HS-203 | Indian Knowledge System* | 2 | | 2 |
| PC | ECC-205 | Signals and Systems | 3 | | 3 |
| PC | ECC-207 | Digital Logic and Computer Design | 4 | | 4 |
| PC | ECC-209 | Analog Communications | 4 | | 4 |
| PC | ECC-211 | Analog Electronics-I | 4 | | 4 |
| Practical / Viva Voce | | | | | |
| ES | ES-251 | Computational Methods Lab | | 2 | 1 |
| PC | ECC-253 | Digital Logic and Computer Design Lab | | 2 | 1 |
| PC | ECC-255 | Analog Communications Lab | | 2 | 1 |
| PC | ECC-257 | Analog Electronics-I Lab | | 2 | 1 |
| PC | ECC-259 | Signals and Systems Lab | | 2 | 1 |
| Total | | | 21 | 10 | 26 |

***NUES:**All examinations to be conducted by the concerned teacher as specified in the detailed syllabus of the paper.

| | | Fourth Semester | | | |
|---|---|---|---|---|---|
| Group | Paper Code | Paper | L | P | Credits |
| Theory Papers | | | | | |
| BS | BS-202 | Probability, Statistics and Linear Programming | 4 | | 4 |
| HS/MS | HS-204 | Technical Writing* | 2 | | 2 |
| PC | EEC-206 | Network Analysis and Synthesis | 3 | | 3 |
| PC | ECC-210 | Microprocessors and Microcontrollers | 3 | | 3 |
| PC | ECC-212 | Digital Communications | 3 | | 3 |
| PC | ECC-214 | Analog Electronics-II | 3 | | 3 |
| PC | ECC-216 | Electromagnetic Field Theory | 3 | | 3 |
| Practical / Viva Voce | | | | | |
| BS | BS-252 | Probability, Statistics and Linear Programming Lab | | 2 | 1 |
| PC | ECC-256 | Microprocessors and Microcontrollers Lab | | 2 | 1 |
| PC | ECC-258 | Digital Communications Lab | | 2 | 1 |
| PC | ECC-260 | Analog Electronics-II Lab | | 2 | 1 |
| PC | EEC-262 | Network Analysis and Synthesis Lab | | 2 | 1 |
| Total | | | 21 | 10 | 26 |

***NUES:**All examinations to be conducted by the concerned teacher as specified in the detailed syllabus of the paper.

| Paper Code(s): ECC-255 | L | P | C |
|---|---|---|---|
| **Paper: Analog Communications Lab** | - | 2 | 1 |

| **Marking Scheme:** |
|---|
| 1. Teachers Continuous Evaluation: 40 marks |
| 2. Term end Theory Examinations: 60 marks |
| **Instructions:** |
| 1. The course objectives and course outcomes are identical to that of (Analog Communications) as this is the practical component of the corresponding theory paper. |
| 2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list. |

1. Generation of DSB-SC AM signal using balanced modulator.

2. To study amplitude demodulation by linear diode detector

3. Generation of SSB AM signal.

4. To study envelop detector for demodulation of AM signal and observe diagonal peak clipping effect.

5. To generate FM signal using voltage controlled oscillator.

6. To generate a FM Signal using Varactor & reactance modulation.

7. Detection of FM Signal using PLL & foster seelay method.

8. To study Super heterodyne AM receiver and measurement of receiver parameters viz.sensitivity, selectivity & fidelity.

9. To study Pre-emphasis and De-emphasis in FM.

10. Generation of Phase modulated and demodulated signal.

| Paper Code(s): ECC-211 | L | P | C |
|---|---|---|---|
| Paper: Analog Electronics – I | 4 | - | 4 |

| | |
|---|---|
| **Marking Scheme:** | |
| 1. Teachers Continuous Evaluation: 25 marks | |
| 2. Term end Theory Examinations: 75 marks | |
| **Instructions for paper setter:** | |
| 1. There should be 9 questions in the term end examinations question paper. | |
| 2. The first (1ˢᵗ) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks. | |
| 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15. | |
| 4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. | |
| 5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required. | |

| | |
|---|---|
| **Course Objectives:** | |
| **1.** | To develop understanding of operation, characteristics, parameters and applications of p-n junction diode |
| **2.** | To develop understanding about BJT and FET in terms of structure, operation, configurations and characteristics. Also analyse stability and amplifier circuit using small signal models |
| **3.** | To impart knowledge of cascade amplifiers, coupling schemes, power amplifiers and their analysis |
| **4.** | To impart knowledge of Feedback amplifiers and oscillators |
| **Course Outcome (CO):** | |
| **CO 1** | Ability to understand of operation, characteristics, parameters and applications of p-n junction diode |
| **CO 2** | Ability to understand about BJT and FET in terms of structure, operation, configurations and characteristics and able to analyse stability and amplifier circuit using small signal models |
| **CO 3** | Ability to understand and analyse cascade amplifiers, coupling schemes in amplifiers and power amplifiers |
| **CO 4** | Ability to understand feedback amplifiers and oscillators |

**Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 2 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 4 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |

**UNIT – I**

Open circuit P-N junction diode, Forward and reverse biased diode, I-V characteristics of diode, Diode Equation, Temperature dependence of diode. Breakdown phenomena, diffusion and transition capacitance of diode. Diode equivalent circuit, Ideal diode. Solar cell.
Diode circuits: half-wave and full-wave rectifiers with capacitor filter, clamping and clipping circuits. Zener diodes as voltage regulator.

**UNIT – II**

Bipolar Junction transistor (BJT): Structure, modes of operation, Configurations, I-V characteristics, early effect, junction voltages; Transistor Biasing: Need of biasing, load line concept, fixed bias, self-bias, collector to base bias, stability factors, Current Mirrors; hybrid model of BJT amplifier, small signal analysis of CE BJT amplifier using h parameter
JFET: Physical structure, I-V characteristics; MOSFET: Depletion and enhancement types, Physical structure and I-V characteristics; FET small-signal model (low & high frequency); MOSFET as resistance and switch,

**UNIT – III**

Cascade amplifiers: Analysis of cascade amplifier (voltage gain, current gain, input and output impedances); Darlington pair, Cascode amplifier; Types of coupling: DC, RC and Transformer; RC coupled Amplifier and its frequency response; Differential Amplifier: differential and Common mode operation, CMRR.
Power Amplifiers: Classification of output stages (Class A, B, C & AB), Class A Amplifier, Transformer coupled class A amplifier, Push pull amplifiers: Class A and Class B, Harmonic distortion, efficiency, crossover distortion, class AB operation, Class C amplifier.

**UNIT – IV**

Feedback Amplifiers: classification, Feedback concept, basic feedback topologies, Characteristics of Negative Feedback, Feedback and stability, gain margin, Noise margin,
Sinusoidal Oscillator, Barkhausen criterion, RC phase shift, LC (Colpitt's, Hartley, Clapp), Crystal Oscillator.

**Textbook(s):**
1. J. Millman, C.C. Halkias and Satyabrata Jit, "Electronic Devices and Circuits", Tata McGraw Hill, 4th ed. , 1998
2. R. L. Boylestad and N. Nashlesky, "Electronic Devices and Circuit Theory", Pearson Education, 11th Ed., 2014

**References:**
1. Adel S. Sedra and Kenneth C. Smith, "Micro Electronic Circuits Theory and  Applications," 5th Edition , OUP, 2004.
2. B. Kumar and S. B. Jain, "Electronic Devices and Circuits"", Prentice Hall of India, 2007
3. S Salivahanan, and N. Suresh Kumar, "Electronic Devices and Circuits", McGraw Hill Education (India), 2018
4. B.P. Singh and Rekha Singh, "Electronic Devices and Integrated Circuits", Pearson Education, 2009.
5. J. J. Cathey, "Schaum's Outline of Theory and Problems in Electronic Devices and Circuits", McGraw Hill, 2002.

| Paper Code(s): ECC-257 | L | P | C |
|---|---|---|---|
| **Paper: Analog Electronics – I Lab** | - | 2 | 1 |

| |
|---|
| **Marking Scheme:** |
| 1. Teachers Continuous Evaluation: 40 marks |
| 2. Term end Theory Examinations: 60 marks |
| **Instructions:** |
| 1. The course objectives and course outcomes are identical to that of (Analog Electronics - I) as this is the practical component of the corresponding theory paper. |
| 2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list. |

1. To plot V-I characteristics of a semiconductor diode & Calculate Static & Dynamic Resistance.

2. To Study the Reverse characteristics of Zener diode

3. To Study the Rectifier circuit (With and Without Filter).

    a. Half Wave Rectifier

    b. Centre Tapped Rectifier.

    c. Bridge Rectifier.

4. Plotting input and output characteristics and calculation of parameters of a transistor in common

    emitter configuration.

5. Transistor biasing circuit. Measurement of operating point (Ic and Vce) for a :-

    a. fixed bias circuit

    b. potential divider biasing circuit.

6. Plot the FET characteristics & MOSFET characteristics.

7. To measure the overall gain of two stages at 1 KHz and compare it with gain of Ist stage,
   Also to observe the loading effect of second stage on the first stage

8. To plot the frequency response curve of two stage amplifier.

9. To study Emitter follower circuit & measurement of voltage gain and plotting of frequency response

    Curve.

10. Feedback in Amplifier. Single stage amplifier with and without bypass capacitor, measurement of voltage gain and plotting the frequency response in both cases.

11. To determine and plot firing characteristics of SCR by varying anode to cathode voltage, and varying gate current.

12. To note the wave shapes and voltages at various points of a UJT relaxation oscillator circuit.

13. For Transistorized push pull amplifier Measurement of optimum load, maximum undistorted power (by giving maximum allowable signal) Efficiency and percentage distortion factor.

14. To study the characteristics of single tuned & double tuned amplifier.

| Paper Code(s): ES-251 | L | P | C |
|---|---|---|---|
| Paper: Computational Methods Lab | - | 2 | 1 |

| Marking Scheme: |
|---|
| 1. Teachers Continuous Evaluation: 40 marks |
| 2. Term end Theory Examinations: 60 marks |
| **Instructions:** |
| 1. The course objectives and course outcomes are identical to that of (Computational Methods) as this is the practical component of the corresponding theory paper. |
| 2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list. |

**Implementation to be done in C/C++**

1. Program for finding roots of f(x)=0 Newton Raphson method.

2. Program for finding roots of f(x)=0 by bisection method.

3. Program for finding roots of f(x)=0 by secant method.

4. To implement Langrange's Interpolation formula.

5. To implement Newton's Divided Difference formula.

6. Program for solving numerical integration by Trapezoidal rule

7. Program for solving numerical integration by Simpson's 1/3 rule

8. To implement Numerical Integration Simpson 3/8 rule.

9. Inverse of a system of linear equations using Gauss-Jordan method.

10. Find the Eigen values using Power method.

11. Program for solving ordinary differential equation by Runge-Kutta Method.

| Paper Code(s): ES-201 | L | P | C |
|---|---|---|---|
| **Paper: Computational Methods** | 4 | - | 4 |

| Marking Scheme: |
|---|
| 1.  Teachers Continuous Evaluation: 25 marks |
| 2.  Term end Theory Examinations: 75 marks |
| **Instructions for paper setter:** |
| 1.  There should be 9 questions in the term end examinations question paper. |
| 2.  The first (1ˢᵗ) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks. |
| 3.  Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15. |
| 4.  The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. |
| 5.  The requirement of (scientific) calculators / log-tables / data – tables may be specified if required. |
| **Course Objectives :** |

| 1. | To understand numerical methods to find roots of functions and first order unconstrained minimization of functions. |
|---|---|
| 2. | To introduce concept of interpolation methods and numerical integration. |
| 3. | To understand numerical methods to solve systems of algebraic equations and curve fitting by splines. |
| 4. | To understand numerical methods for the solution of Ordinary and partial differential equations. |

| **Course Outcomes (CO)** | |
|---|---|
| CO 1 | Ability to develop mathematical models of low level engineering problems |
| CO 2 | Ability to apply interpolation methods and numerical integration. |
| CO 3 | Ability to solve simultaneous linear equations and curve fitting by splines |
| CO 4 | Ability to numerically solve ordinary differential equations that are initial value or boundary value problems |

**Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)**

|  | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 3 | 2 | 2 | 2 | 2 | - | - | - | 2 | 2 | 2 | 3 |
| CO 2 | 3 | 2 | 2 | 2 | 2 | - | - | - | 2 | 2 | 2 | 3 |
| CO 3 | 3 | 3 | 3 | 3 | 2 | - | - | - | 2 | 2 | 2 | 3 |
| CO 4 | 3 | 3 | 3 | 3 | 2 | - | - | - | 2 | 2 | 2 | 3 |

**UNIT-I**

Review of Taylor Series, Rolle 's Theorem and Mean Value Theorem, Approximations and Errors in numerical computations, Data representation and computer arithmetic, Loss of significance in computation
Location of roots of equation: Bisection method (convergence analysis and implementation), Newton Method (convergence analysis and implementation), Secant Method (convergence analysis and implementation). Unconstrained one variable function minimization by Fibonacci search, Golden Section Search and Newton's method. Multivariate function minimization by the method of steepest descent, Nelder- Mead Algorithm.

**UNIT-II**

Interpolation: Assumptions for interpolation, errors in polynomial interpolation, Finite differences, Gregory-Newton's Forward Interpolation, Gregory-Newton's backward Interpolation, Lagrange's Interpolation, Newton's divided difference interpolation
Numerical Integration: Definite Integral, Newton-Cote's Quadrature formula, Trapezoidal Rule, Simpson's one-third rule, simpson's three-eight rule, Errors in quadrature formulae, Romberg's Algorithm, Gaussian Quadrature formula.

**UNIT-III**

System of Linear Algebraic Equations: Existence of solution, Gauss elimination method and its computational effort, concept of Pivoting, Gauss Jordan method and its computational effort, Triangular Matrix factorization methods: Dolittle algorithm, Crout's Algorithm, Cholesky method, Eigen value problem: Power method Approximation by Spline Function: First-Degree and second degree Splines, Natural Cubic Splines, B Splines, Interpolation and Approximation

**UNIT - IV**

Numerical solution of ordinary Differential Equations: Picard's method, Taylor series method, Euler's and Runge-Kutta's methods, Predictor-corrector methods: Euler's method, Adams-Bashforth method, Milne's method.
Numerical Solution of Partial Differential equations: Parabolic, Hyperbolic, and elliptic equations
Implementation to be done in C/C++

**Textbook(s):**
1. E. Ward Cheney & David R. Kincaid , "Numerical Mathematics and Computing" Cengage; 7th ed (2013).

**References:**
1.  R. L. Burden and J. D. Faires, "Numerical Analysis", CENGAGE Learning Custom Publishing; 10th Edition (2015).
2. S. D. Conte and C. de Boor, "Elementary Numerical Analysis: An Algorithmic Approach", McGraw Hill, 3rd ed. (2005).
3. H. M. Antia, "Numerical Methods for Scientists & Engineers", Hindustan Book Agency, (2002).
4. E Balagurusamy "Numerical Methods" McGraw Hill Education (2017).

| **Digital Logic and Computer Design** | **L** | **P** | **C** |
|---|---|---|---|
| | **4** | | **4** |

| Discipline(s) / EAE / OAE | Semester | Group | Sub-group | Paper Code |
|---|---|---|---|---|
| CSE/IT/CST/ITE/ECE | 3 | PC | PC | ECC-207 |
| OAE | 6 | CSE-OAE | CSE-OAE-1B | OCSE-308 |
| OAE | 7 | ECE-OAE | ECE-OAE-3A | OECE-415 |

| |
|---|
| **Marking Scheme:** |
| 1. Teachers Continuous Evaluation: 25 marks |
| 2. Term end Theory Examinations: 75 marks |
| **Instructions for paper setter:** |
| 1. There should be 9 questions in the term end examinations question paper. |
| 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks. |
| 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15. |
| 4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. |
| 5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required. |
| **Course Objectives :** |
| 1. To introduce basic concepts of Boolean Algebra and Combinational Logic |
| 2. To introduce various sequential circuits, designing with examples |
| 3. To relate combination circuit design and sequential circuit design with respect to the design of a computer system |
| 4. To introduce machine learning, computer arithmetic, modes of data transfer with respect to I/O and Memory organization of a computer |
| **Course Outcomes (CO)** |
| CO 1 Ability to understand Boolean Algebra and Design Combinational Circuit. |
| CO 2 Ability to understand and Design Sequential Circuits. |
| CO 3 Ability to understand Design of a basic computer. |
| CO 4 Ability to understand Input-Output and Memory Organization of a Computer. |

**Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)**

| | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 3 | 2 | 3 | 2 | 2 | - | - | - | 3 | 2 | 2 | 3 |
| CO 2 | 3 | 2 | 3 | 2 | 2 | - | - | - | 3 | 2 | 2 | 3 |
| CO 3 | 3 | 2 | 3 | 3 | 2 | - | - | - | 3 | 2 | 2 | 3 |
| CO 4 | 3 | 3 | 3 | 3 | 3 | - | - | - | 3 | 2 | 2 | 3 |

**UNIT – I**

**Boolean Algebra and Combinational Logic**: Review of number systems , signed, unsigned, fixed point, floating point numbers, Binary Codes, Boolean algebra – basic postulates, theorems , Simplification of Boolean function using Karnaugh map and Quine-McCluskey method – Implementations of combinational logic functions using gates, Adders, Subtractors, Magnitude comparator, encoder and decoders, multiplexers, code converters , parity generator/checker, implementation of combinational circuits using multiplexers.

**UNIT – II**

**Sequential Circuits:** General model of sequential circuits, Flip-flops, latches , level triggering, edge triggering, master slave configuration , concept of state  diagram , state table, state reduction procedures , Design of synchronous sequential circuits , up/down and modulus counters , shift registers, Ring counter , Johnson counter , timing diagram , serial adder , sequence detector, Programmable Logic Array (PLA), Programmable Array Logic (PAL), Memory Unit, Random Access Memory

**UNIT – III**

**Basic Computer organization**: Stored Program, Organization, Computer registers, bus system, instruction set completeness, instruction cycle, Register Transfer Language, Arithmetic, Logic and Shift Micro-operations, Instruction Codes, Design of a simple computer, Design of Arithmetic Logic unit, shifter, Design of a simple hardwired control unit,  Programming the basic computer, Machine language instructions, assembly language, Microprogrammed control, Horizontal and Vertical Microprogramming, Central Processing Unit, instruction sets and  formats, addressing modes, data paths, RISC and CISC characteristics.

**UNIT – IV**

Computer Arithmetic, addition, subtraction, multiplication and division algorithms, Input-Output Organization, Modes of data transfer, Interrupt cycle, direct memory access, Input-Output processor,  Memory Organization, Memory Hierarchy, Associative Memory, Cache Memory, Internal and external Memory, Virtual Memory.

**Text Book(s)**
1.  M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016
2.  M. Morris Mano,  Rajib Mall "Computer System Architecture", 3rd Edition Pearson Education, 2017

**References:**
1. Leach, D. P., Albert P. Malvino,  "Digital Principles and Applications",  McGraw Hill, 8th Edition , 2014
2. Jain, R.P. ,"Modern Digital Electronics", McGraw Hill Education, 4th Edition , 2010
3. Floyd, Thomas L. , "Digital Fundamentals"  Pearson Education, 11th  Edition, 2017
4. M. Rafiquzzaman, "Fundamentals of Digital Logic and Microcomputer Design", Wiley, 5th Ed., 2005.

| Paper Code(s): ECC-253 | L | P | C |
|---|---|---|---|
| Paper: Digital Logic and Computer Design Lab | - | 2 | 1 |

| Marking Scheme: |
|---|
| 1. Teachers Continuous Evaluation: 40 marks |
| 2. Term end Theory Examinations: 60 marks |
| **Instructions:** |
| 1. The course objectives and course outcomes are identical to that of (Digital Logic and Computer Design) as this is the practical component of the corresponding theory paper. |
| 2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list. |

1.  Design and implementation of adders and subtractors using logic gates.

2.  Design and implementation of 4-bit binary adder/subtractor.

3.  Design and implementation of multiplexer and demultiplexer.

4.  Design and implementation of encoder and decoder.

5.  Construction and verification of 4-bit ripple counter and Mod-10/Mod-12 ripple counter.

6.  Design and implementation of 3-bit synchronous up/down counter.

7.  Design and computer architecture: Design a processor with minimum number of instructions, so that it can do the basic arithmetic and logic operations.

8.  Write an assembly language code in GNUsim8085 to implement data transfer instruction.

9.  Write an assembly language code in GNUsim8085 to store numbers in reverse order in memory location.

10. Write an assembly language code in GNUsim8085 to implement arithmetic instruction.

11. Write an assembly language code in GNUsim8085 to add two 8 bit numbers.

12. Write an assembly language code in GNUsim8085 to find the factorial of a number.

13. Write an assembly language code in GNUsim8085 to implement logical instructions.

14. Write an assembly language code in GNUsim8085 to implement stack and branch instructions.

| Paper Code(s): HS-203 | L | P | C |
|---|---|---|---|
| **Paper: Indian Knowledge System** | 2 | - | 2 |

| Marking Scheme: |
|---|
| 1. Teachers Continuous Evaluation: 25 marks |
| 2. Term end Theory Examinations: 75 marks |
| 3. This is an NUES paper, hence all examinations to be conducted by the concerned teacher. |

| Instruction for paper setter: |
|---|
| 1. There should be 9 questions in the term end examinations question paper. |
| 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks. |
| 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15. |
| 4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. |
| 5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required. |

| Course Objectives : | |
|---|---|
| 1. | To understand the Indian knowledge System. |
| 2. | To understand the foundational concepts for science and technology. |
| 3. | To understand the ancient Indian mathematics and astronomy. |
| 4. | To understand the ancient Indian engineering and technology. |

| Course Outcomes (CO) | |
|---|---|
| CO 1 | Ability to understand the Indian knowledge System. |
| CO 2 | Ability to understand and apply foundational concepts for science and technology. |
| CO 3 | Ability to understand and apply ancient Indian mathematics and astronomy |
| CO 4 | Ability to understand ancient Indian engineering and technology. |

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

| | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | - | - | - | - | - | 3 | - | - | - | - | - | 2 |
| CO 2 | - | - | - | - | - | 3 | - | - | - | 2 | - | 2 |
| CO 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 2 |
| CO 4 | 3 | 3 | - | - | - | - | - | - | - | - | - | 2 |

**UNIT-I**

Indian Knowledge System (IKS) - An Introduction:
Overview of IKS - Importance of Ancient Knowledge; Defining IKS; The IKS Corpus – A Classification Framework; Chaturdaśa-Vidyāsthāna; History of IKS, Some unique aspects of IKS;
The Vedic Corpus – Introduction to Vedas; The Four Vedas and their divisions; Vedāngas; Vedic Life;
Philosophical Systems – Indian Philosophical Systems; Vedic Schools of Philosophy; Non-Vedic Philosophical Systems; Wisdom through the Ages – Purānas, Itihāsa as source of wisdom, Rāmāyana, Mahābhārata, Niti-śāstras, Subhāssitas.

**UNIT-II**

Foundational Concepts for Science and Technology:
Linguistics - Components of Language; Pānini's work on Sanskrit Grammar; Phonetics in Sanskrit; Patterns in Sanskrit Vocabulary; Computational Concepts in Astādhyāyi, Logic for Sentence Construction; Importance of Verbs; Role of Sanskrit in Natural Language Processing

Number System and Units of Measurement – Number System in India; Salient Features of the Indian Numeral System; Unique approaches to represent numbers; Measurements for Time, Distance and Weight; Pingala and the Binary System

Knowledge: Framework and Classification – The Knowledge Triangle; Prameya; Pramāna; Samśaya; Framework for establishing Valid Knowledge

**UNIT-III**

Mathematic and Astronomy in IKS:

Mathematics – Unique aspects of Indian Mathematics; Great Mathematicians and their Contributions; Arithmetic; Geometry; Trigonometry; Algebra; Binary Mathematics and Combinatorial Problems in Chandah-śāstra of Pingala, Magic Squares in India

Astronomy - Unique aspects of Indian Astronomy; Historical Development of Astronomy in India; The Celestial Coordinate System; Elements of the Indian Calendar; Āryabhatiya and the Siddhāntic Tradition; Pancānga; Astronomical Instruments; Jantar Mantar of Rājā Jai Singh Sawai

**UNIT - IV**

Engineering and Technology in IKS:

Engineering and Technology: Metals and Metalworking – The Indian S & T Heritage; Mining and Ore Extraction; Metals and Metalworking Technology; Iron and Steel in India; Lost wax casting  of Idols and Artefacts; Apparatuses used for Extraction of Metallic Components

Engineering and Technology: Other Applications – Literary sources for Science and Technology; Physical Structures in India; Irrigation and Water Management; Dyes and Painting Technology; Surgical Techniques; Shipbuilding; Sixty-four Art Forums; Status of Indigenous S & T

**Textbook(s):**
1. B. Mahadevan, Vinayaka Rajat Bhat & Nagendra Pavana R.N., "Introduction to Knowledge System: Concepts and Applications" PHI (2022).

**References:**
1.  C.M Neelakandhan & K.A. Ravindran, "Vedic Texts and The Knowledge Systems of India", Sri Sankaracharya University of Sanskrit, Kalady (2010).
2.  P.P. Divakaran, "The Mathematics of India: Concepts, Methods, Connections", Springer (2018)
3. C.A. Sharma, "Critical Survey of Indian Philosophy", Motilal Banarasidass Publication (1964)
4. G. Huet, A. Kulkarni & P. Scharf, "Sanskrit Computational Linguistics", Springer (2009).
5. A.K. Bag, "History of Technology in India", Indian National Science Academy, Vol 1, (1997)

| Paper Code(s): ECC-259 | L | P | C |
|---|---|---|---|
| **Paper: Signals and Systems Lab** | - | 2 | 1 |

| Marking Scheme: |
|---|
| 1.  Teachers Continuous Evaluation: 40 marks |
| 2.  Term end Theory Examinations: 60 marks |
| **Instructions:** |
| 1.  The course objectives and course outcomes are identical to that of (Signals and Systems) as this is the practical component of the corresponding theory paper. |
| 2.  The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list. |

1.  Introduction to MATLAB and its basic commands.

2.  Plot unit step, unit impulse, unit ramp, exponential, parabolic functions and sinusoidal signals

3.  Plot the linear convolution of two sequences.

4.  Plot the correlation of two sequences.

5.  Plot the magnitude and phase spectra of a signal using Fourier transforms.

6.  Plot the magnitude and phase spectrum of signal using Fourier series.

7.  Find out the Z transform of a signal and check the stability using pole zero location.

8.  Plot the spectra of ideally sampled signal w.r.t. sampling of Discrete time signals.

9.  Verification of few properties of Fourier transform.

10. Evaluate the DTFS coefficients of a signal and plot them.

11. Plot the step response for any impulse response entered by user.

| Paper Code(s): ECC-205 | L | P | C |
|---|---|---|---|
| Paper: Signals and Systems | 3 | - | 3 |

| Marking Scheme: |
|---|
| 1. Teachers Continuous Evaluation: 25 marks |
| 2. Term end Theory Examinations: 75 marks |
| **Instructions for paper setter:** |
| 1. There should be 9 questions in the term end examinations question paper. |
| 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks. |
| 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15. |
| 4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. |
| 5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required. |

| Course Objectives: | |
|---|---|
| 1. | To impart understanding about various types of signals and systems, their classifications, analysis and operations. |
| 2. | To impart knowledge of use of transforms in analysis of signals and system. |
| 3. | To impart skill to carry out simulation on signals and systems for observing effects of applying various properties and operations. |
| 4. | To impart strong foundation of communication and signal processing to be studied in the subsequent semester |

| Course Outcome (CO): | |
|---|---|
| CO 1 | Ability to understand about various types of signals and systems, classify them, analyze them, and perform various operations on them. |
| CO 2 | Ability to understand use of transforms in analysis of signals and system. |
| CO 3 | Ability to carry out simulation on signals and systems for observing effects of applying various properties and operations. |
| CO 4 | Ability to create strong foundation of communication and signal processing to be studied in the subsequently. |

| Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
| CO 1 | 3 | 3 | 3 | 3 | 2 | - | - | - | 1 | 1 | 1 | 1 |
| CO 2 | 3 | 3 | 3 | 3 | 2 | - | - | - | 1 | 1 | 1 | 1 |
| CO 3 | 3 | 3 | 3 | 3 | 2 | - | - | - | 1 | 1 | 1 | 1 |
| CO 4 | 3 | 3 | 3 | 3 | 2 | - | - | - | 1 | 1 | 1 | 1 |

**Unit I**

Continuous and discrete time signals: Classification of Signals – Periodic aperiodic even – odd – energy and power signals – Deterministic and random signals – complex exponential and sinusoidal signals – periodicity – properties of discrete time complex exponential unit impulse – unit step impulse functions – Transformation in independent variable of signals: time scaling, time shifting. Determination of Fourier series representation of continuous time and discrete time periodic signals – Explanation of properties of continuous time and discrete time Fourier series. Representation of continuous time signals by its sample - Sampling theorem – Reconstruction of a Signal from its samples, aliasing – discrete time processing of continuous time signals, sampling of band pass signals.

**Unit II**

Continuous time Fourier Transform and Laplace Transform analysis with examples – properties of the Continuous-time Fourier Transform and Laplace Transform basic properties, Parseval's relation, and convolution in time and frequency domains.

Basic properties of continuous time systems: Linearity, Causality, time invariance, stability, magnitude and Phase representations of frequency response of LTI systems -Analysis and characterization of LTI systems using Differential Equations and Continuous time LTI systems. Laplace transform: Computation of impulse response and transfer function using Laplace transform.

**Unit III**

Discrete time system analysis using Difference equations, Discrete Time Fourier Transform, Discrete Fourier Transform, FFT and their property and usage in the analysis of Discrete time systems.

**Unit IV**

Basic principles of z-transform - z-transform definition – region of convergence – properties of ROC – Properties of z-transform – Poles and Zeros – inverse z-transform using Contour integration - Residue Theorem, Power Series expansion and Partial fraction expansion, Relationship between z-transform and Fourier transform. Properties of convolution and the interconnection of LTI Systems – Causality and stability of LTI Systems. Computation of Impulse & response & Transfer function using Z Transform.

**Textbook(s):**
1. Alan V. Oppenheim, Alan S. Willsky with S. Hamid Nawab, "Signals & Systems", 2nd ed., Pearson Education, 1997.
2. Simon Haykin and Barry Van Veen, "Signals and Systems", John Wiley, 1999

**References:**
1. M. J. Roberts, "Signals and Systems Analysis using Transform method and MATLAB", TMH 2003.
2. K. Lindner, "Signals and Systems", McGraw Hill International, 1999.
3. Moman .H. Hays," Digital Signal Processing ", Schaum's outlines, Tata McGraw-Hill Co Ltd., 2004.
4. B. P. Lathi, "Signal Processing and Linear System", Berkeley Cambridge Press, 1998.
5. H. P. Hsu, "Schaum's Outlines of The Theory and Problems of Signals and Systems", McGraw-Hill, 1995.
6. John G.Proakis and Dimitris G.Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications, 3rd edn., PHI, 2000.

| Paper Code(s):  ECC-260 | L | P | C |
|---|---|---|---|
| **Paper: Analog Electronics – II Lab** | - | 2 | 1 |

| **Marking Scheme:** |
|---|
| 1. Teachers Continuous Evaluation: 40 marks |
| 2. Term end Theory Examinations: 60 marks |
| **Instructions:** |
| 1. The course objectives and course outcomes are identical to that of (Analog Electronics - II) as this is the practical component of the corresponding theory paper. |
| 2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list. |

1. To study the op-amp (IC 741) as inverting and non-inverting amplifier and calculate its gain.

2. Observe and plot the output Wave shape of Op-Amp R-C differentiating circuits,
   R-C integrating circuits for square wave input

3. To study the op-amp (IC 741) as adder, subtractor and voltage follower, calculate its output voltage..

4. Construct biased and unbiased series and shunt clipping circuits & combinational clipper
   circuit for positive and negative peak clipping of a sine wave.

5. To study RC phase shift/Wien Bridge oscillator
   measurement of frequency and amplitude of oscillations using Op-Amp.

6. To study the waveform of square wave generator using 741 Op-Amp IC.

7. To study the waveform of Schmitt Trigger circuit & Precision Rectifier using 741 OP-AMP IC.

8. To make and test the operations of Monostable Multivibrator circuits using 555 timer.

9. To make and test the operations of Astable Multivibrator circuits using 555 timer.

10. To study the Sallen Key Voltage controlled voltage source active filters.

| Paper Code(s): ECC-214 | L | P | C |
|---|---|---|---|
| Paper: Analog Electronics – II | 3 | - | 3 |

| Marking Scheme: |
|---|
| 1. Teachers Continuous Evaluation: 25 marks |
| 2. Term end Theory Examinations: 75 marks |
| **Instructions for paper setter:** |
| 1. There should be 9 questions in the term end examinations question paper. |
| 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks. |
| 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15. |
| 4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. |
| 5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required. |

| Course Objectives: | |
|---|---|
| **1.** | To understand Basic building block and characteristic of Op-Amp |
| **2.** | To understand the frequency response and Configurations of Op-Amp |
| **3.** | To analyze and design linear, nonlinear and Oscillators circuits using Op-Amp |
| **4.** | To analyze and design active filters and to understand function of Op-Amp based special ICs |

| Course Outcome (CO): | |
|---|---|
| CO 1 | Ability to understand and use Op-Amps to design open-loop and closed loop configuration. |
| CO 2 | Ability to analyse frequency response of and Op-Amp circuit. |
| CO 3 | Ability to use Op-Amp in linear and non-linear applications. |
| CO 4 | Ability to design Active Filters |

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 2 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 4 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |

**UNIT – I**

The Operational Amplifiers: Block diagram representation of OP-AMP; Evolution of IC and types, Power supply for Op-Amp; The Ideal Op-Amp: schematic, characteristics, equivalent circuit, Ideal voltage transfer curve, typical IC 741 characteristics
Open Loop Op-Amp configurations: The differential amplifier, inverting amplifier, non-inverting amplifier
Closed loop Op-Amp configurations: inverting and non-inverting amplifiers, voltage followers, differential amplifiers, closed loop frequency response & circuit stability, single supply operation of OP-AMP, Inverting and Non-Inverting op-amp.

**UNIT – II**

The Practical Op-Amp: Input offset voltage, input bias current, input offset current, Total output offset voltage, thermal drift, error voltage, Supply voltage rejection ration (SVRR), CMRR
Frequency Response of An Op-Amp: Frequency response compensator networks, High frequency OP-AMP equivalent circuit, open loop voltage gain as a function of frequency, Slew rate, causes of slew rates and its effects in application.

**UNIT – III**

Linear applications of Op-Amps: Summing, scaling and averaging amplifier (inverting, non-inverting & differential configuration), voltage to current & current to voltage converters, Integrator, Differentiator,
Non-Linear applications of IC op-amps: Comparator, Zero crossing detector, Schmitt Trigger, Clipping & Clamping Circuits, Precision Rectifiers, sample and hold circuit
Oscillators: Principles & Types; Phase shift, Wein-bridge & quadrature. Square wave, triangular wave and saw tooth wave generators, voltage-controlled oscillator

**UNIT – IV**

Active Filters: Classification and frequency response of filters, response Advantages of active filters, characteristics of butter worth, chebyshev, first order and second order butter worth filters- low pass and high pass types. Band pass & band reject filters.
Specialised IC- The 555 Timer: functional diagram, Monostable and Astable multivibrators; PLL: Basic PLL principle, monolithic 565 PLL; Voltage Regulators, Three terminal IC voltage regulators(LM 317

**Textbook(s):**
1. Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2001.
2. D. Roy Choudhary & S. B Jain, "Linear Integrated Circuit", 2nd ed. New age publication.2018.

**References:**
1. Adel S. Sedra and Kenneth C. Smith, "Micro Electronic Circuits Theory and Applications," 5th Edition , OUP, 2004.
2. David A. Bell, "Op-amp & Linear ICs", Oxford, 2013.
3. James M. Fiore, "Op Amps & Linear Integrated Circuits Concepts & Applications", Cengage, 2010.
4. J. Michel Jacob, "Applications and Design with Analog Integrated Circuits", PHI, 2004.
5. R. L. Boylestad and N. Nashlesky, "Electronic Devices and Circuit Theory", Pearson Education, 11th Ed., 2014
6. J. Millman, C. Halkias, and C. D. Parikh, "Millman's Integrated Electronics: Analog and Digital circuits and system", McGraw Hill Education, 2018.

| Paper Code(s): ECC-258 | L | P | C |
|---|---|---|---|
| Paper: Digital Communications Lab | - | 2 | 1 |

| Marking Scheme: |
|---|
| 1. Teachers Continuous Evaluation: 40 marks |
| 2. Term end Theory Examinations: 60 marks |
| **Instructions:** |
| 1. The course objectives and course outcomes are identical to that of (Digital Communications) as this is the practical component of the corresponding theory paper. |
| 2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list. |

1. To Study Sampling Theorem.

2. To Study Pulse Code Modulation.

3. To Study Differential Pulse Code Modulation.

4. To Study Delta Modulation.

5. To Study Adaptive Delta Modulation.

6. To Study Amplitude Shift Keying (ASK) and calculate its S/N ratio and Probability of error.

7. To Study Phase Shift Keying (PSK) and calculate its S/N ratio and Probability of error.

8. To Study frequency Shift Keying (FSK) and calculate its S/N ratio and Probability of error.

9. To Study Differential Phase Shift Keying Modulation (DPSK) and calculate its S/N ratio and Probability of error.

10. To Study Quadrature Phase Shift Keying Modulation (QPSK) and calculate its S/N ratio and Probability of error.

11. To Study Quadrature Amplitude Modulation (QAM) and calculate its S/N ratio and Probability of error.

| Paper Code(s): ECC-212 | L | P | C |
|---|---|---|---|
| **Paper: Digital Communications** | **3** | **-** | **3** |

| Marking Scheme: |
|---|
| 1. Teachers Continuous Evaluation: 25 marks |
| 2. Term end Theory Examinations: 75 marks |
| **Instructions for paper setter:** |
| 1. There should be 9 questions in the term end examinations question paper. |
| 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks. |
| 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15. |
| 4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. |
| 5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required. |

| Course Objectives: | |
|---|---|
| **1.** | To understand importance of information theory in digital communication and various PCM modulation. |
| **2.** | To understand the various basic concepts of digital communication. |
| **3.** | To understand the various digital Modulation-demodulation techniques |
| **4.** | To understand various coding in digital communications. |

| Course Outcome (CO): | |
|---|---|
| CO 1 | Ability to understand the need of digital communication and conversion of analog to digital signals. |
| CO 2 | Ability to understand the effect of additive white Gaussian Noise on digital communication modulation techniques. |
| CO 3 | Ability to analyse the effect of inter symbol interference as the source of channel impairment and the effect of multipath phenomenon. |
| CO 4 | Ability to use and design communication systems for reliable communication |

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 2 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 4 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |

**UNIT I**

Review of probability theory and Stochastic processes, Poisson and Gaussian Process, Noise, Narrowband Noise, Sinewave plus Narrowband Noise. Sampling Theory, PAM, Quantization characteristics, PCM, DPCM, Delta Modulation, Adaptive Delta Modulation, Line Codes.

**UNIT II**

AWGN Channel Signalling: Geometric Representation of Signals, Conversion of Continuous AWGN Channel to a vector channel: ASK, QASK, FSK, M-array FSK, BPSK, DPSK, DEPSK, QPSK, M-array PSK, QAM, MSK, GMSK, Coherent and non-coherent detection and other keying techniques.

**UNIT III**

Band Limited Channels: Error rate due to channel noise in a matched filer receiver, Intersymbol Interference, Signal Design for Zero ISI, Raised cosine and square root raised cosine spectrum, Eye pattern, Adaptive equalization, signalling over multiple baseband channel, Fading Channels: Propagation effects, Jakes Model,

Statistical Characteristics of wideband wireless channel, Diversity techniques, MIMO, MIMO Capacity for channel known at receiver, OFDM, Spread-spectrum signals.

**UNIT IV**

Information Theory: Entropy, Source Coding Theorem, Lossless data compression, Discrete Memoryless channel, Mutual Information, Channel Capacity, Channel Coding Theorem, Differential Entropy and Mutual Information for Continuous Random Ensembles, Information Capacity Law. Error Control Coding: Introduction, Error Control using forward correction, Linear Block Code, Cyclic Codes, Convolutional Codes.

**Textbook(s):**
1. Simon Haykins, "Digital Communication Systems" John Wiley, 2014

**References:**
1. Simon Haykins and Michael Moher, "Communication Systems" John Wiley &sons Inc, 5th edition, 2009.
2. B P Lathi and Zhi Ding, "Modern Digital and Analog Communication Systems", OUP, 5th edition, 2019
3. H P Hsu, Schaum Outline Series,  Analog and Digital Communications, TMH 2006
4. J.G Proakis, Digital Communication, 4th Edition, Tata Mc Graw Hill Company, 2001.

| Economics for Engineers | | | L | P | C |
|---|---|---|---|---|---|
| | | | 2 | | 2 |

| Discipline(s) / EAE / OAE | Semester | Group | Sub-group | Paper Code |
|---|---|---|---|---|
| All | 5 | HS/MS | HS | HS-301 |

**Marking Scheme:**
1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

**Instructions for paper setter:**
1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objectives :**
| 1. | To explain the basic micro and macro economics concepts. |
|---|---|
| 2. | To analyze the theories of production, cost, profit and break even analysis. |
| 3. | To evaluate the different market structures and their implications for thebehavior of the firm. |
| 4. | To apply the basics of national income accounting and business cycles toIndian economy. |

**Course Outcomes (CO)**
| CO 1 | Analyze the theories of demand, supply, elasticity and consumer choicein the market. |
|---|---|
| CO 2 | Analyze the theories of production, cost, profit and break even analysis. |
| CO 3 | Evaluate the different market structures and their implications for thebehavior of the firm. |
| CO 4 | Apply the basics of national income accounting and business cycles toIndian economy. |

**Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)**
| | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | 1 | 2 | 1 | - | 1 | - | 1 | 1 | 3 | 1 |
| CO 2 | 1 | 2 | 1 | 2 | 1 | - | 1 | - | 1 | 1 | 3 | 1 |
| CO 3 | 1 | 2 | 1 | 2 | 1 | - | 1 | - | 1 | 1 | 3 | 1 |
| CO 4 | 1 | 2 | 1 | 2 | 1 | - | 1 | - | 1 | 1 | 3 | 1 |

**UNIT-I**

**Introduction:** Economics Definition, Basic economic problems, Resource constraints and welfare maximization. Microand Macro economics. Production Possibility Curve.Circular flow of economic activities.
**Basics of Demand, Supply and Equilibrium:** Demand side and supply side of the market. Factors affecting demand & supply. Elasticity of demand & supply – price, income and cross-price elasticity. Market equilibrium price.

**UNIT-II**

**Theory of Consumer Choice:** Theory of Utility and consumer's equilibrium.Indifference Curve analysis, Budget Constraints, Consumer Equilibrium.
**Demand forecasting:**Regression Technique, Time-series, Smoothing Techniques: Exponential, Moving AveragesMethod

| Paper Code(s): ECC-213 / ECC-216 | L | P | C |
|---|---|---|---|
| **Paper: Electromagnetic Field Theory** | 3 | - | 3 |

| |
|---|
| **Marking Scheme:** |
| 1. Teachers Continuous Evaluation: 25 marks |
| 2. Term end Theory Examinations: 75 marks |
| **Instructions for paper setter:** |
| 1. There should be 9 questions in the term end examinations question paper. |
| 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks. |
| 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15. |
| 4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. |
| 5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required. |
| **Course Objectives :** |
| 1. To impart the basic laws of electrostatics. |
| 2. To impart the knowledge of electromagnetics. |
| 3. To impart the knowledge of solution to real life plan wave problems for various boundary conditions. |
| 4. To impart the knowledge of characteristics and impudence transformation on high frequency transmission lines. |
| **Course Outcomes (CO)** |
| CO 1 Ability to understand the basic laws of electrostatics. |
| CO 2 To understand the basic laws of electromagnetics. |
| CO 3 Ability to provide solution of real life plan wave problems for various boundary conditions. |
| CO 4 To understand the characteristics and impudence transformation on high frequency transmission lines |

**Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)**

| | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 2 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 4 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |

**UNIT I**

Introduction: Review of scalar and vector field, Dot and Cross products, Coordinate Systems-Cartesian, cylindrical and spherical. Vector representation of surface, Physical interpretation of gradient divergence and curl, Transformation of vectors in different co-ordinate systems, dirac-delta function.
Electrostatics: Electric field due to point-charges, line charges and surface charges, Electrostatic potential, Solution of Laplace and Poisson's equation in one dimension, M-method of image applied to plain boundaries, field mapping and conformal transformation, Electric flux density, Boundary conditions. Capacitance: calculation of capacitance for simple rectangular, cylindrical and spherical geometries, Electrostatic energy.

[T1,T2]

**UNIT II**

Magnetostatics : Magnetic Induction and Faraday's Law, Magnetic Flux Density, Magnetic Field Strength H, Ampere, Gauss Law in the Differential Vector Form, Permeability, Energy Stored in a Magnetic Field, Ampere's Law for a Current Element, Volume Distribution of Current , Ampere's Law Force Law, Magnetic Vector Potential, The Far Field of a Current Distribution, Maxwell's Equations: The Equation of Continuity for Time Varying Fields, Inconsistency of Ampere's Law, Maxwell's Equations, Conditions at a Boundary Surface.

[T1,T2]

**UNIT III**

Electromagnetic Waves: Continuity equations, Displacement current, Maxwell's equation, Boundary conditions, Plane wave equation and its solution in conducting and non-conducting media, Phasor notation, Phase velocity, Group velocity, Depth of penetration, Conductors and dielectrics, Impedance of conducting medium. Polarization, Reflection and refraction of plane waves at plane boundaries, Poynting vectors, and Poynting theorem.
[T1,T2]

**UNIT IV**

Transmission Lines: Transmission line equations, Characteristic impendence, Distortion-less lines, Input impendence of a loss less line, computation of primary and secondary constants, Open and Short circuited lines, Standing wave and reflection losses, Impedance matching, Loading of lines, Input impedance of transmission lines, RF lines, Relation between reflection coefficient and voltage standing wave ratio (VSWR), Lines of different lengths – $\lambda/2$, $\lambda/4$, $\lambda/8$ lines, Losses in transmission lines, Smith chart and applications, impedance matching Single stub, Double stub. [T1,T2]

**Textbook(s):**
1. Matthew N. O. Sadiku , "Elements of Electromagnetics", Oxford University Press
2. E. C. Jordon, K. G. Balman, "Electromagnetic Waves & Radiation System" PHI – 2nd Edition

**Reference Books:**
1. William H. Hayt, "Engineering Electromagnetics", TMH
2. J.D. Kraus, "Electromagnetics", TMH
3. David K. Cheng," Field and Wave Electromagnetic", 2nd Edition, Pearson Education Asia,2001
4. John R. Reitz, "Foundations of Electromagnetic Theory". Pearson

| Paper Code(s): ECC-256 / ECC-363 | L | P | C |
|---|---|---|---|
| **Paper: Microprocessors and Microcontrollers Lab** | - | 2 | 1 |

| **Marking Scheme:** |
|---|
| 1. Teachers Continuous Evaluation: 40 marks |
| 2. Term end Theory Examinations: 60 marks |
| **Instructions:** |
| 1. The course objectives and course outcomes are identical to that of (Microprocessors and Microcontrollers) as this is the practical component of the corresponding theory paper. |
| 2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list. |

1.  Write a program to add and subtract two 16-bit numbers with/ without carry using 8086.

2.  Write a program to multiply two 8 bit numbers by repetitive addition method using 8086.

3.  Write a Program to generate Fibonacci series.

4.  Write a Program to generate Factorial of a number.

5.  Write a Program to read 16-bit Data from a port and display the same in another port.

6.  Write a Program to generate a square wave using 8254.

7.  Write a Program to generate a square wave of 10 kHz using Timer 1 in mode 1(using 8051).

8.  Write a Program to transfer data from external ROM to internal (using 8051).

9.  Design a Minor project using 8086 Microprocessor (Ex: Traffic light controller/temperature controller etc)

10. Design a Minor project using 8051 Micro controller

| Paper Code(s): ECC-210 / ECC-313 | L | P | C |
|---|---|---|---|
| **Paper: Microprocessors and Microcontrollers** | **3** | **-** | **3** |

| **Marking Scheme:** |
|---|
| 1. Teachers Continuous Evaluation: 25 marks |
| 2. Term end Theory Examinations: 75 marks |
| **Instructions for paper setter:** |
| 1. There should be 9 questions in the term end examinations question paper. |
| 2. The first (1ˢᵗ) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks. |
| 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15. |
| 4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. |
| 5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required. |
| **Course Objectives:** | |
|---|---|
| **1.** | To impart knowledge about architecture and instruction set of 8085 microprocessor so that students can implement 8085 assembly language programs. |
| **2.** | To impart knowledge about architecture and instruction set of 8086 microprocessor so that students can implement 8086 assembly language programs. |
| **3.** | To impart knowledge about interfacing of 8255, 8254/8253, 8251, 8259 and I/O devices with 8086 microprocessor. |
| **4.** | To impart knowledge about architecture and operation of 8051 microcontroller and their interfacing with memory and I/O. |
| **Course Outcome (CO):** | |
| **CO 1** | Ability to understand and distinguish the use of different 8085 instructions, timing diagram, addressing modes, interrupts and apply those instructions for implementing assembly language programs. |
| **CO 2** | Ability to analyse the timing diagrams, understand its instruction set, assess its memory organisation and will implement the assembly language programs , interfacing of memory with 8086 successfully |
| **CO 3** | Understand and realize the interfacing of 8255 (PPI), 8254/8255 (PIT), 8251 (USART), 8259 (PIC), 8279 (Keyboard and display), Sample and hold circuit, DAC/ADC, LCD & Stepper motor with 8086 microprocessor. |
| **CO 4** | Understand the architecture and operation of 8051 microcontroller and ability to use them for designing various applications based on 8051 by implementing the elaborate instruction set. |

**Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 3 | 3 | 3 | 2 | - | 1 | 1 | - | - | - | - | 1 |
| CO 2 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | - | | - | | 1 |
| CO 3 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | - | 1 | - | - | 1 |
| CO 4 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | - | - | - | - | 1 |

**UNIT - I**

**Introduction to Microprocessor Systems:** Architecture and PIN diagram of 8085, Timing Diagram, memory organization, addressing modes, interrupts. Assembly Language Programming.

**UNIT – II**

**8086 Microprocessor:** 8086 Architecture, difference between 8085 and 8086 architecture, generation of physical address, PIN diagram of 8086, Minimum Mode and Maximum mode, Bus cycle, Memory Organization, Memory

Interfacing, Addressing Modes, Assembler Directives, Instruction set of 8086, Assembly Language Programming, Hardware and Software Interrupts.

**UNIT – III**

**Interfacing of 8086 with 8255, 8254/8253, 8251, 8259:** Introduction, Generation of I/O Ports, Programmable Peripheral Interface (PPI)-Intel 8255, Sample-and-Hold Circuit and Multiplexer, Keyboard and Display Interface, Keyboard and Display Controller (8279), Programmable Interval timers (Intel 8253/8254), USART (8251), PIC (8259), DAC, ADC, LCD, Stepper Motor.

**UNIT – IV**

**Overview of Microcontroller 8051:** Introduction to 8051 Micro-controller, Architecture, Memory organization, Special function registers, Port Operation, Memory Interfacing, I/O Interfacing, Programming 8051 resources, interrupts, Programmer's model of 8051, Operand types, Operand addressing, Data transfer instructions, Arithmetic instructions, Logic instructions, Control transfer instructions, Timer & Counter Programming, Interrupt Programming.

**Textbook(s):**
1. Muhammad Ali Mazidi, "Microprocessors and Microcontrollers", Pearson, 2006
2. Douglas V Hall, "Microprocessors and Interfacing, Programming and Hardware" Tata McGraw Hill, 2006.
3. Ramesh Gaonkar, "MicroProcessor Architecture, Programming and Applications with the 8085", PHI

**References:**
1. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. MCKinlay "The 8051 Microcontroller and Embedded Systems",2nd Edition, Pearson Education 2008.
2. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC", Delmar Publishers, 2007.
3. A K Ray, K M Bhurchandi, "Advanced Microprocessors and Peripherals", Tata McGraw Hill, 2007.
4. Vaneet Singh, Gurmeet Singh, "Microprocessor and Interfacing", Satya Prakashan, 2007.

| Paper Code(s): EEC-262 | L | P | C |
|---|---|---|---|
| **Paper: Network Analysis and Synthesis Lab** | - | 2 | 1 |

| |
|---|
| **Marking Scheme:** |
| 1. Teachers Continuous Evaluation: 40 marks |
| 2. Term end Theory Examinations: 60 marks |
| **Instructions:** |
| 1. The course objectives and course outcomes are identical to that of (Network Analysis and Synthesis) as this is the practical component of the corresponding theory paper. |
| 2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list. |

1. Introduction to MATLAB and its basic commands.

2. Plot unit step, unit impulse, unit ramp, exponential, parabolic functions and sinusoidal signals

3. Study the transient response of series RLC circuit for different types of waveforms on CRO and verify using MATLAB

4. Study the time response of a simulated linear system and verify the unit step and square wave response of first order and second order, type 0,1 system

5. Using MATLAB determine current in various resistors connected in network using mesh current and node voltage analysis.

6. To determine Z and Y parameters of the given two port network.

7. To determine ABCD parameters of the given two port network.

8. To verify Reciprocity Theorem for the given two port network.

9. To determine Hybrid parameters of the given two port network.

10. To design Cascade Connection and determine ABCD parameters of the given two port network.

11. To design Series-Series Connection and determine Z parameters of the given two port network.

12. To design Parallel-Parallel Connection and determine Y parameters of the given two port network.

13. To design Series-Parallel Connection and determine h parameters of the given two port network

14. Study the frequency response of different filter circuits.

| Paper Code(s): EEC-206 | L | P | C |
|---|---|---|---|
| **Paper: Network Analysis and Synthesis** | 3 | - | 3 |

| Marking Scheme: |
|---|
| 1. Teachers Continuous Evaluation: 25 marks |
| 2. Term end Theory Examinations: 75 marks |
| **Instructions for paper setter:** |
| 1. There should be 9 questions in the term end examinations question paper. |
| 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks. |
| 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15. |
| 4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. |
| 5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required. |
| **Course Objectives:** |
| **1.** | To understand the network theorem in AC circuit. |
| **2.** | To understand mathematical modelling of circuit. |
| **3.** | To understand two port parameter and transfer function. |
| **4.** | To understand realization of passive network and filter. |
| **Course Outcome (CO):** |
| CO 1 | Ability to apply network theorems in AC circuit. |
| CO 2 | Ability to determine transient respond of circuit. |
| CO 3 | Ability to determine two port parameter of circuit. |
| CO 4 | Ability to realize the circuit from their transfer function. |

**Course Objectives:**

| **1.** | To understand the network theorem in AC circuit. |
|---|---|
| **2.** | To understand mathematical modelling of circuit. |
| **3.** | To understand two port parameter and transfer function. |
| **4.** | To understand realization of passive network and filter. |

**Course Outcome (CO):**

| CO 1 | Ability to apply network theorems in AC circuit. |
|---|---|
| CO 2 | Ability to determine transient respond of circuit. |
| CO 3 | Ability to determine two port parameter of circuit. |
| CO 4 | Ability to realize the circuit from their transfer function. |

**Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 2 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |
| CO 4 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 1 | - | 2 |

**UNIT-I**

Application of Mesh current analysis, Node voltage analysis and Network theorems in AC circuits.
Graph theory: concept of tree, tie set matrix, cut set matrix and application to solve electric networks.

**UNIT-II**

Periodic waveforms and signal synthesis, properties and applications of Laplace transform of complex waveform. System modeling in terms of differential equations and transient response of R, L, C, series and parallel circuits for impulse, step, ramp, sinusoidal and exponential signals by classical method and using Laplace transform.

**UNIT-III**

Two port networks – Introduction of two port parameters and their interconversion, interconnection of two 2-port networks, open circuit and short circuit impedances and ABCD constants, relation between image impedances and short circuit and open circuit impedances. Network functions, their properties and concept of transform impedance, Hurwitz polynomial.

**UNIT IV**

Positive real function and synthesis of LC, RC, RL Networks in Foster's I and II, Cauer's I& II forms, Introduction of passive filter and their classification, frequency response, characteristic impedance of low pass, high pass, Band Pass and Band reject prototype section.

**Textbook(s):**
1. W H Hayt "Engineering Circuit Analysis" TMH Eighth Edition
2. Kuo, "Network analysis and synthesis" John Weily and Sons, 2nd Edition.

**Reference Books:**
1. S Salivahanan "Circuit Theory " Vikas Publishing House 1st Edition 2014
2. Van Valkenburg, " Network analysis" PHI, 2000.
3. Bhise, Chadda, Kulshreshtha, " Engineering network analysis and filter design" Umesh publication, 2000.
4. D. R. Choudhary, "Networks and Systems" New Age International, 1999
5. Allan H Robbins, W.C.Miller "Circuit Analysis theory and Practice"Cengage Learning Pub 5th Edition 2013
6. Bell "Electric Circuit" Oxford Publications 7th Edition.

| Paper Code(s): BS-252 | L | P | C |
|---|---|---|---|
| Paper: Probability, Statistics and Linear Programming Lab | - | 2 | 1 |

| |
|---|
| **Marking Scheme:** |
| 1. Teachers Continuous Evaluation: 40 marks |
| 2. Term end Theory Examinations: 60 marks |
| **Instructions:** |
| 1. The course objectives and course outcomes are identical to that of (Probability, Statistics and Linear Programming) as this is the practical component of the corresponding theory paper. |
| 2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list. |

**Implementation to be done in MATLAB or in equivalent software.**

1. Installation of Scilab and demonstration of simple programming concepts like marix multiplication (scalar and vector), loop, conditional statements and plotting.

2. Program for demonstration of theoretical probability limits.

3. Program to plot normal distributions and exponential distributions for various parametric values.

4. Fitting of binomial distributions for given n and p.

5. Fitting of binomial distributions after computing mean and variance.

6. Fitting of Poisson distributions for given value of lambda.

7. Fitting of Poisson distributions after computing mean.

8. Fitting of normal distribution when parameters are given.

9. Fitting of linear regression line through given data set and testing of goodness of fit using mean error.

10. Fitting of Multiple Linear Regression (MLR) curve through given data set and testing of goodness of fit using mean error.

11. Solve a LPP of three variable using Simplex Method.

12. Solve a Transportation problem of three variables.

13. Solve an Assignment problem of three variables.

| Paper Code(s): BS-202 | L | P | C |
|---|---|---|---|
| **Paper: Probability, Statistics and Linear Programming** | 4 | - | 4 |

| **Marking Scheme:** |
|---|
| 1.  Teachers Continuous Evaluation: 25 marks |
| 2.  Term end Theory Examinations: 75 marks |
| **Instructions for paper setter:** |
| 1.  There should be 9 questions in the term end examinations question paper. |
| 2.  The first (1$^{st}$) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks. |
| 3.  Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15. |
| 4.  The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. |
| 5.  The requirement of (scientific) calculators / log-tables / data – tables may be specified if required. |
| **Course Objectives:** |
| 1: | To understand probability and probability distributions. |
| 2: | To understand methods of summarization of data. |
| 3: | To understand and use test for hypothesis. |
| 4: | To understand methods for solving linear programming problems. |
| **Course Outcomes (CO):** |
| CO1: | Ability to solve probability problems and describe probability distributions. |
| CO2: | Ability to describe and summarize data. |
| CO3: | Ability to use test for hypothesis. |
| CO4: | Ability to formulate and solve linear programming problems. |

**Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | 2 |
| **CO2** | - | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | 2 |
| **CO3** | - | 3 | 2 | 2 | 1 | - | - | - | - | - | 2 | 2 |
| **CO4** | - | 3 | 3 | 3 | 1 | - | - | - | - | - | 2 | 2 |

**Unit I**

Basics: Probability and Statistical models, Sample Spaces and Events, Counting Techniques, Interpretations and Axioms of Probability, Unions of Events and Addition Rules, Conditional Probability, Intersections of Events and Multiplication and Total Probability Rules, Independence, Bayes' Theorem, Random Variables.
Discrete and Continuous Random Variables and Distributions:  Probability Distributions and Probability Mass / density Functions, Cumulative Distribution Functions, Mean and Variance of a Random Variable, Discrete and continuous Uniform Distribution, Binomial Distribution, Geometric and Negative Binomial Distributions, Hypergeometric Distribution, Poisson Distribution. Normal Distribution, Normal Approximation to the Binomial, and Poisson Distributions; Exponential Distribution, Erlang and Gamma Distributions, Weibull Distribution, Lognormal Distribution, Beta Distribution.

**Unit II**

Joint Probability Distributions for Two Random Variables, Conditional Probability Distributions and Independence, Joint Probability Distributions for Two Random Variables, Covariance and Correlation, Common Joint Distributions, Linear Functions of RandomVariables, General Functions of Random Variables, Moment-Generating Functions.
Numerical Summaries of Data, Stem-and-Leaf Diagrams, Frequency Distributions and Histograms, Box Plots, Time Sequence Plots, Scatter Diagrams, Probability Plots. Point Estimation, Sampling Distributions and the Central

Limit Theorem without proof, General Concepts of Point Estimation, Methods of Point Estimation, Statistical Intervals for a Single Sample.

**Unit III**

Hypotheses Testing for a SingleSample: Tests on the Mean of a Normal Distribution with Variance Known / Unknown, Tests on the Variance and Standard Deviationof a Normal Distribution, Tests on a Population Proportion, Testing for Goodness of Fit, Nonparametric tests (Signed, Wilcoxon), Similarly Statistical Inference forTwo Samples.
Regression and Correlation: Linear Regression, Least Squares Estimators, Hypotheses testing for simple linear regression, Confidence Intervals, Adequacy of model, Correlation, Transformed Variables, Logistic Regression. Similarly, for multiple linear regression including aspects of MLR.

**Unit IV**

Linear Programming: Introduction, formulation of problem, Graphical method, Canonical and Standard form of LPP, Simplex method, Duality concept, Dual simplex method, Transportation and Assignment problem.

**Textbooks:**
1. *Applied Statistics and Probability for Engineers* by Douglas G. Montgomery and Runger, Wiley, 2018
2. *Linear Programming* by G. Hadley, Narosa, 2002

**References:**
1. *Miller and Freund's Probability and Statistics for Engineers* by Richard A. Johnson, Pearson, 10th Ed., 2018.
2. *Probability & Statistics for Engineers & Scientists* by Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Pearson, 2016.
3. *Statistics and probability with applications for engineers and scientists using Minitab, R and JMP*, C. Gupta, Irwin Guttman, and Kalanka P. Jayalath, Wiley, 2020.
4. *Probability and Statistics for Engineering and the Sciences*, Jay Devore, Cengage Learning, 2014.
5. *Probability and Statistics in Emgineering*, William W. Hines, Douglas C. Montgomery, David M. Goldman, and Connie M. Borror, Wiley, 2003.
6. *Operations Research: An Introduction* by Hamdy A. Taha, Pearson, 10th Edition, 2016

| Paper Code(s): HS-204 | L | P | C |
|---|---|---|---|
| **Paper: Technical Writing** | **2** | **-** | **2** |

| Marking Scheme: |
|---|
| 1.   Teachers Continuous Evaluation: 25 marks |
| 2.   Term end Theory Examinations: 75 marks |
| 3.   This is an NUES paper, hence all examinations to be conducted by the concerned teacher. |

| Instruction for paper setter: |
|---|
| 1.  There should be 9 questions in the term end examinations question paper. |
| 2.  The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks. |
| 3.  Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15. |
| 4.  The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. |
| 5.  The requirement of (scientific) calculators / log-tables / data – tables may be specified if required. |

| Course Objectives: | |
|---|---|
| 1: | To improve grammar and sentence structure and build vocabulary. |
| 2: | To understand how to write different types of writings. |
| 3: | To understand how to compose different types of business documents. |
| 4: | To understand business ethics and develop soft skills. |

| Course Outcomes (CO): | |
|---|---|
| CO1: | Ability to improve grammar and sentence structure and build vocabulary. |
| CO2: | Ability to write different types of writings with clarity. |
| CO3: | Ability to write different types of business documents. |
| CO4: | Ability to apply business ethics and enhance personality. |

| Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High ||||||||||||
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
| **CO1** | - | - | - | - | - | 1 | - | - | - | 3 | - | - |
| **CO2** | - | - | - | - | - | 1 | - | - | - | 3 | - | - |
| **CO3** | - | - | - | - | - | 1 | - | - | - | 3 | - | - |
| **CO4** | - | - | - | - | - | 1 | - | 3 | - | 3 | - | - |

**Unit I**

Grammar and Vocabulary--- Types of sentences (simple, complex and compound) and use of connectives in sentences, Subject-verb agreement, Comprehension, Synonyms and Antonyms, Homophones and Homonyms, Word Formation: Prefixes and Suffixes, Indianism, Misappropriation and Redundant Words, Question Tags and Short Responses.

**Unit II**

Writing Styles -- Expository, Explanatory, Descriptive, Argumentative and Narrative.
Precis writing, Visual Aids in Technical Writing, Plagiarism and Language Sensitivity in Technical Writing, Dialogue Writing, Proposals: Purpose and Types.

**Unit III**

Letters at the Workplace—letter writing: Request, Sales, Enquiry, Order and Complaint.
Job Application---Resume and Cover letter, Difference between Resume and CV, Preparation for Interview.
Meeting Documentation--- Notice, Memorandum, Circular, Agenda, Office Order and Minutes of meeting, Writing Instructions.

**Unit IV**

Ethics and Personality Development-----The Role of Ethics in Business Communication—Ethical Principles, Time Management, Self-Analysis through SWOT and JOHARI Window, Emotional Intelligence and Leadership Skills, Team Building, Career Planning, Self Esteem.

**Textbook:**
1. Meenakshi Raman and Sangeeta Sharma, Technical Communication: Principles and Practice, Oxford University Press, New Delhi (2015).

**References:**
1. Sanjay Kumar and Pushp Lata, Communication Skills, Oxford University Press, New Delhi (2015).
2.  Herta A Murphy, Herbert W Hildebrandt, Jane P Thomas, Effective Business Communication, Tata McGraw-Hill, Hill Publishing Company Limited, Seventh Edition.