**Semester III**

**ECOMP 310 Mathematics - III**

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| ECOMP 310 | Mathematics - III | 3 | 1 | – | 3 | 100 | 25 | 25 | – | – | 150 | 4 |

**Course Objective:**

The subject aims to equip the student with:

1. Mathematical tools necessary to formulate, solve and analyze engineering problems
2. An understanding of graph theory and matrix theory in order to apply them to problems arising in the field of engineering.
3. An understanding of Laplace transforms to solve problems arising in the field of engineering.
4. An understanding of Fourier transforms and Z- transforms to solve Engineering problems.

**Course Outcome:**

Upon completion of the course, students will be able to

| | |
|---|---|
| ECOMP 310.1 | Demonstrate an understanding of various graph algorithms and apply the concepts of graph theory |
| ECOMP 310.2 | Carry out matrix operations including inverses and determinants, demonstrate an understanding of linear independence, solve systems of linear equations, compute rank, Eigenvalues, Eigenvectors of a given matrix and diagonalize matrices |
| ECOMP 310.3 | Compute Laplace transform and it's inverse and apply Laplace transform to obtain solutions of differential and integral equations |
| ECOMP 310.4 | Calculate Fourier and Z- transforms and their inverses, apply Z-transform to solve difference equations and use the Fourier transform as a tool to solve integral equations |

| UNIT-1 | |
|---|---|
| **Graph Theory:** Graphs and graph models, graph terminology and special types of graphs, representing graphs and graph isomorphism, connectivity, Euler and Hamilton paths, shortest path problems.<br>Trees: Introduction to Trees, applications of trees, tree traversal, Spanning Trees, Minimal Spanning Trees. | **9 Hrs.** |
| **UNIT-2** | |
| **Matrix Algebra:** Matrices: Types, Determinants, Transpose and Inverse of Matrix. Elementary transformations: Rank and Normal Form, Linearly Dependent and Linearly independence of vectors, Solving systems of Linear homogeneous and non-homogeneous equations.<br>Eigenvalue and Eigenvectors, Diagonalization using Similarity transformations, Cayley-Hamilton theorem and its applications, Minimal Polynomial | **10 Hrs.** |
| **UNIT-3** | |
| **Laplace Transform:** Definition. Existence conditions, properties, inverse Laplace transforms. Laplace transform of periodic functions, Convolution theorem, Laplace transform of Dirac-Delta function, Application of Laplace transforms in solving linear differential equations with initial conditions and system of linear simultaneous differential equations | **10 Hrs.** |
| **UNIT-4** | |
| **Fourier Transform:** Fourier Transform, Inverse Fourier transform, Fourier Sine and Cosine transform, Convolution and its application.<br>**Z-Transform:** Definition, region of convergence, properties, Z-transform on impulse function, Convolution theorem, application to difference equations | **10 Hrs.** |

| TEXT BOOKS | |
|---|---|
| 1 | B. S. Grewal; Higher Engineering Mathematics; Khanna Publications, New Delhi |
| 2 | Swapan Kumar Sarkar; Discrete Mathematics; S. Chand Publication |

| REFERENCE BOOKS | |
|---|---|
| 1 | E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015 |
| 2 | Kenneth H. Rosen; Discrete Mathematics and Its Applications; Tata McGraw Hill (6th edition) |

| TERM WORK |
|---|
| Students can be evaluated based on assignments / class tests / seminars / quiz / viva etc. |

## ECOMP 320 Network Analysis and Synthesis

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| ECOMP 320 | Network Analysis and Synthesis | 3 | 1 | – | 3 | 100 | 25 | 25 | – | – | 150 | 4 |

**Course Objective:**

The subject aims to equip the student with:

1. Ability to analyse linear electrical networks and perform Time domain analysis of electrical networks
2. An understanding of graph theory and its application for network analysis
3. Ability to synthesize an electrical network and model it into any equivalent Two port network
4. An understanding of analysing and designing of attenuators
5. Ability to synthesize circuits using Foster and Cauer form

**Course Outcome:**

Upon completion of the course, students will be able to

| | |
|---|---|
| ECOMP 320.1 | Explain the concepts related to electrical networks and graph theory |
| ECOMP 320.2 | Apply network theorems, differential equations, and Laplace transforms to compute transient and steady state response of circuits |
| ECOMP 320.3 | Analyse electrical networks to compute two port parameters, design resonant circuits and attenuators. |
| ECOMP 320.4 | Design and synthesize electrical networks |

| UNIT-1 | |
|---|---|
| **Network Classification:** Distributed and lumped, passive and active, time variable and time invariant, symmetrical and asymmetrical networks.<br>**Network Analysis:** Mesh and nodal analysis (ac and dc sources), super-node and super-mesh analysis.<br>**Network Theorems (AC and DC analysis):** Thevenin's theorem, Maximum power transfer theorem, Norton's theorem, Superposition theorem, Reciprocity theorem. | **10 Hrs.** |
| **UNIT-2** | |
| **Graph Theory:** Basic definitions, Duality, Matrices associated with network graphs: Incidence, Tieset, Cutset matrices.<br>**Time- domain analysis:** Network equations in time- domain, first and second order circuits (RL, RC and RLC circuits), Initial condition, Analysis of transient and steady state response to step and sinusoidal input. | **10 Hrs.** |

| | |
|---|---|
| **Application of Laplace transform to analysis of networks:** Response of RL, RC and RLC circuits to step and sinusoidal input. | |
| **UNIT-3** | |
| **Resonance:** Series resonance, Impedance and Phase angle of series Resonant Circuit, Band Width of an RLC circuit, selectivity and Q-factor of resonance circuits. Parallel resonance- Band Width, selectivity and Q-factor of resonance circuits.<br>**Two Port Networks:** Characterization in terms of Z, Y, H and ABCD parameters, Equivalent circuits; interrelationship between the two port parameters | **10 Hrs.** |
| **UNIT-4** | |
| **Impedance of two port networks:** input, output, characteristic impedance, and image impedances of two ports.<br>**Elements of Network Synthesis:** Hurwitz polynomials, Positive real functions, Reactance functions, RL and RC functions (Foster method and Cauer method).<br>**Attenuators:** Classification, Analysis and design of T, pi, Lattice and Bridged T attenuator. | **10 Hrs.** |

| **TEXT BOOKS** | |
|---|---|
| 1 | A. Sudhakar & P. Shyamohan; Circuits & Networks- Analysis and Synthesis; Tata McGraw-Hill.2006 |
| 2 | M.E. Van Valkenburg; Network Analysis; 3e Pearson Education. 2015 |
| 3 | D. Roy Choudhary; Networks & systems; New Age International Publishers.2005. |

| **REFERENCES** | |
|---|---|
| 1 | F. F. Chuo; Network Analysis and Synthesis; 2nd edition, Wiley Eastern 2006 |
| 2 | A. Chakrabarti; Circuit theory Analysis and Synthesis); Dhanpat Rai Publishing Company. 2018 |

| **TERM WORK** |
|---|
| Students can be evaluated based on assignments / class tests / mini-project / seminars / quiz / viva / presentations / circuit simulations, etc. |

## ECOMP 330 Electronics Devices and Circuits

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| ECOMP 330 | Electronics Devices and Circuits | 3 | 1 | – | 3 | 100 | 25 | 25 | – | – | 150 | 4 |

**Course Objective:**

The subject aims to provide the student with:

1. An understanding of quantitative and qualitative analysis of PN Junction diode and ability to analyze and design circuits using diodes.
2. Ability to perform DC analysis and AC small signal analysis for BJT biasing circuits and to perform DC analysis of JFET and MOSFET biasing circuits.
3. An understanding of multistage and large signal amplifier, feedback mechanism and its application in amplifier and oscillator circuits.
4. Ability to analyze and design integrator, differentiator, and multivibrator circuits.

**Course Outcome:**

Upon completion of the course, students will be able to

| | |
|---|---|
| ECOMP330.1 | Explain the concept of qualitative and quantitative theory of PN Junction diode in semiconductors |
| ECOMP330.2 | Analyse and design diode circuits such as rectifiers, filters, clippers and clampers and RC Integrators and Differentiators |
| ECOMP330.3 | Examine various DC biasing circuits for BJT, JFET and MOSFET and perform small signal analysis using BJT hybrid and re models for various biasingconfigurations |
| ECOMP330.4 | Analyze the multistage and large signals BJT amplifiers |
| ECOMP330.5 | Analyze the different configurations of negative feedback in amplifier circuits and discuss the effect of negative and positive feedback on amplifiers and oscillators |
| ECOMP330.6 | Analyze and design different types of oscillators, transistor switch and Multivibrator circuits. |

| UNIT-1 | |
|---|---|
| **Semiconductor Diode Characteristics**: Qualitative theory of the PN junction, Quantitative theory of the p-n diode currents, VI characteristic and temperature dependence<br>**Diode and Circuits:** Load Line Analysis; Diode Approximations; Series, Parallel and Series-Parallel Diode Configurations; Clippers and clampers.<br>**Rectifiers and Filters:** C, LC analysis and design, Voltage Regulation | **9 Hrs.** |

| | |
|---|---|
| using Zener diodes.<br>**Linear Wave-shaping:** RC Low pass and high pass circuits, Steady stateresponse of RC differentiator & integrating circuits to square wave. | |
| **UNIT-2** | |
| **DC Biasing of BJT:** Operating Point, transistor biasing circuits (Fixed-Bias Emitter-Stabilized Bias, Voltage- Divider Bias, collector feedback and emitter follower circuit)<br>**BJT AC Analysis (for voltage divider bias):** BJT transistor modeling, $r_e$ transistor model, BJT small signal analysis using re transistor model, hybrid equivalent model, approximate hybrid equivalent circuit, complete hybrid equivalent model.<br>**FET Biasing:** (JFETs and Depletion –type FET) Fixed-Bias, Self-Bias and Voltage-Divider Bias Configurations (both n- and p-channel), common gate configuration; Enhancement-Type MOSFETs-Feedback Biasing Arrangement, Voltage –Divider Biasing Arrangement | **10 Hrs.** |
| **UNIT-3** | |
| **Multistage Amplifiers:** Cascading, Coupling techniques: RC, transformer and direct, Cascode, Darlington pair.<br>**Power amplifiers:** classification, Class A (Direct coupled with resistive load, transformer coupled with resistive load), Class B, Push-pull amplifier, crossover distortion, Class AB Push-pull amplifier and complementary Symmetry, Class C<br>**Negative feedback in amplifiers (using block diagram and typical transistor circuits for each configuration):** Voltage series, voltage shunt, current series, and current shunt types of feedback. Effect of negative feedback on input and output impedance, voltage and current gains, bandwidth, noise and distortion. | **10 Hrs.** |
| **UNIT-4** | |
| **Positive feedback:** Concept of feedback and stability, Barkhausen criterion, Types of oscillators – Tuned LC, Hartley's, Colpitts, RC phase shift, crystal oscillator.<br>**BJT Switch:** BJT as a switch, Junction & Diffusion Capacitance of a BJT, Improving switching times.<br>**Multivibrators:** Analysis & Design of Basic BJT Monostable Multivibrator, BJT Bistable Multivibrator, BJT Astable Multivibrator and BJT Schmitt trigger. | **10 Hrs.** |

| **TEXT BOOKS** | |
|---|---|
| 1 | R. Boylestad & L. Nashelsky; Electronic Devices and Circuits; PHI. |
| 2 | J.B Gupta; Electronic Devices and Circuits; S. K. Kataria & Sons. |
| 3 | J. Millman, C. Halkias & Satyabrata Jit; Electronic Devices and Circuits; McGraw Hill. |
| 4 | David Bell, Solid state Pulse circuits, Oxford University Press |

| **REFERENCES** | |
|---|---|
| 1 | A. Mottershead; Electronic Devices and Circuits; PHI. |
| 2 | A. Anandkumar, Pulse digital circuits, PHI |
| 3 | Anil K. Maini/ Varsha Agarwal, Electronic Devices and Circuits, WILEY |
| 4 | David Bell, Electronic Devices and Circuits, Oxford University Press |

| **TERM WORK** |
|---|
| Students can be evaluated based on assignments / class tests / mini-project / seminars / quiz / viva / presentations / circuit simulations, etc. |

## ECOMP 340 Digital Electronics

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| ECOMP 340 | Digital Electronics | 3 | 1 | – | 3 | 100 | 25 | 25 | – | – | 150 | 4 |

**Course Objective:**

The subject aims to provide the student with:

1. An understanding of various Number Systems & Codes along with Boolean algebra.
2. An ability to solve problems using Boolean algebra, K-maps and VEM
3. An ability to design combinational and sequential circuits.
4. An understanding of digital Logic families

**Course Outcome:**

Upon completion of the course, students will be able to

| | |
|---|---|
| ECOMP340.1 | Perform interconversion of different number systems and perform arithmetic operations using 1's and 2's compliments |
| ECOMP340.2 | Solve Boolean expressions using Boolean algebra, K-maps and VEM and implement them using logic gates |
| ECOMP340.3 | Design and implement any given combinational circuits |
| ECOMP340.4 | Explain different flip flops, registers and their application |
| ECOMP340.5 | Design and implement sequential circuits and compare the characteristics of Digital Logic families |

| UNIT-1 | |
|---|---|
| **Number Systems & Codes**: Decimal, Binary, Hexadecimal, Octal systems; Interconversions, Signed & Unsigned Binary numbers, Complements<br>**Binary Arithmetic**: Addition & Subtraction using 1's & 2's complements. Binary Codes-Decimal codes (BCD, Excess-3, 8421, 2421), Error Detection codes (Parity generation & Detection), Reflected code, Alphanumeric codes (EBCDIC, ASCII), Study of Binary logic with logic gates.<br>**Boolean Algebra**: Postulates & Theorems, Boolean functions and their Algebraic manipulation, Canonical & Standard forms, Minterms & Maxterms.<br>Simplification of Boolean functions: K-maps, POS & SOP simplification and their inter conversions, NAND & NOR implementation, Plotting & Reading of K-map using VEM. | **10 Hrs.** |
| **UNIT-2** | |

| | |
|---|---|
| **Combinational Logic**: Design Procedure for Combinational logic circuits, Design & Analysis of Half Adder, Full Adder, Half Subtractor, Full Subtractor, Code Conversion, binary Parallel Adder, Look-ahead Carry generator, Decimal Adder (BCD Adder), Magnitude Comparator, Decoders, Combinational logic implementation, Demultiplexers, Encoders, Multiplexers, Boolean function implementation with multiplexers, Design of seven segment display, Parity generator, checker.<br>**Flip-flops**: Basic flip-flop circuit, Clocked RS flip-flop, D flip-flop, JK flip-flop, T flip-flop, Triggering of flip-flops, Master Slave flip-flop, Edge triggered flipflops: their schematic symbols, truth table & Excitation table, conversion between different types of flip flops | **10 Hrs.** |
| **UNIT-3** | |
| **Shift Registers**: SISO, SIPO, PISO, PIPO, Bidirectional shift register, Universal shift register, Applications of shift registers.<br>**Asynchronous Counters**: Ripple up counters, ripple down counters, ripple up-down counters (using positive edge and negative edge triggering), Mod n Asynchronous counters.<br>**Synchronous counters**: Design of synchronous counters, Synchronous up counter, synchronous down counter, synchronous up-down counter, Synchronous Mod n Counters, Ring counter, Johnson counter, Applications of counters | **10 Hrs.** |
| **UNIT-4** | |
| **Sequential Circuits**: Design procedure for sequential circuits using state diagrams, state table, state equations, state reduction and assignment, Circuit implementation, Moore & Mealy Machine. Finite state machine.<br>**Digital Logic Families**: Characteristics of Digital ICs, TTL-Operation of TTL NAND gate, Active pull-up, Open Collector output, Wired AND, Schottky TTL, ECL | **9 Hrs.** |

| **TEXT BOOKS** | |
|---|---|
| 1 | M. Morris Mano; Digital Logic and Computer Design; PHI. 2016 |
| 2 | Anand Kumar; Fundamentals of Digital Circuits; 4e PHI. 2016 |
| 3 | R P JAIN ;Modern Digital Electronics ; 4e,Tata Mc Graw Hill |
| 4 | Thomas Floyd; Digital Fundamentals - A Systems Approach; 11e Pearson Education. 2015 |

| **REFERENCES** | |
|---|---|
| 1 | D. Leach, A. P. Malvino, G. Saha; Digital Principles & Applications; 8e Tata McGraw-Hill.2014 |
| 2 | William Fletcher; An Engineering Approach to Digital Design; PHI. 2009 |
| 3 | Vincent P. Heuring, Harry F. Jordan, T.G. Venkatesh; Computer Systems Design and Architecture, 2e PHI 2012 |

| **TERM WORK** |
|---|
| Students can be evaluated based on assignments / class tests / mini-project / seminars / quiz / viva / presentations / circuit simulations, etc. |

**ECOMP 350 Data Structures and Algorithms using C++**

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| ECOMP 350 | Data Structures and Algorithms using C++ | 3 | – | – | 3 | 100 | 25 | – | – | – | 125 | 3 |

**Course Objective:**

The subject aims to provide the student with:

1. Ability to understand the generic principles of object oriented programming using C++
2. An ability to plan, design, execute and document sophisticated object oriented programs to handle different computing problems
3. An ability to use data structures as the foundational base for computer solutions to engineering problems
4. An ability to plan, design, execute and document sophisticated technical programs to handle various sorts of data structures using object oriented principles

**Course Outcome:**

Upon completion of the course, students will be able to

| | |
|---|---|
| ECOMP350.1 | Illustrate the concept of object oriented programming |
| ECOMP350.2 | Demonstrate the concepts of function overloading, operator overloading, Inheritance, Pointers, Templates and Exception Handling |
| ECOMP350.3 | Demonstrate the use of data structures like linked lists, stacks and queues. and complex data structures like trees and graphs |
| ECOMP350.4 | Illustrate searching and sorting techniques |

| **UNIT-1** | |
|---|---|
| **Object Oriented Programming**: Basic concepts and benefits of OOP, Basic user-defined and derived data types. Reference variables, Arithmetic and logical operators, scope resolution and memory management operators. Expressions and control structures. Functions in C++, Classes & Objects, Constructors & Destructors | **10 Hrs.** |
| **UNIT-2** | |
| **Operator Overloading:** Definition, Overloading unary and binary operators, manipulation of strings<br>**Inheritance:** derived classes, Types of inheritance, constructors in derived classes, nesting of classes<br>**Pointers:** pointers to objects, this pointer, pointers to derived classes. Virtual functions | **10 Hrs.** |

| | |
|---|---|
| **Templates:** Class templates & Function templates. Exception handling | |
| **UNIT-3** | |
| **Linked list**: Single, Doubly, Circular linked lists<br>**Stacks:** as an array and linked list, applications of stacks<br>**Queues**: as an array and linked list, Circular<br>**Trees:** Traversal of binary tree, BST, operations on BST, Reconstruction of Binary tree | **10 Hrs.** |
| **UNIT-4** | |
| **Graphs:** Definitions and Terminology, DFS & BFS, Spanning Tree<br>**Searching:** Linear search, Binary search<br>**Sorting:** Bubble sort, selection sort, Quick sort, Insertion sort, Merge sort, Heap sort | **9 Hrs.** |

| **TEXT BOOKS** | |
|---|---|
| 1 | Object Oriented Programming with C++ by E. Balagurusamy. |
| 2 | Data Structures using C++ by Yeshwant Kanetkar, BPB Publications |
| 3 | Data Structures using C++ by Tenenbaum |

| **REFERENCES** | |
|---|---|
| 1 | Object Oriented Programming in Turbo C++ by Robert Lafore |
| 2 | Mastering C++ by Venugopal, Rajkumar, Ravishankar |
| 3 | Let Us C++ by Yeshwant Kanetkar |

## ECOMP 360 Analog and Digital Electronics Lab

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| ECOMP 360 | Analog and Digital Electronics Lab | – | – | 2 | - | - | - | – | 25 | – | 25 | 1 |

**Course Objective:**

The subject aims to provide the student with:

**Part A: Analog Electronics**

To understand the concepts, working and characteristics of Diodes, BJT and FET Transistors, amplifiers, and biasing techniques of transistors

**Part B: Digital Electronics**

1. An understanding of the basics of digital electronics
2. An ability to design basic logic circuits, combinational and sequential circuits

**Course Outcome:**

**Part A: Analog Electronics**

Upon completion of the course, students will be able to

| | |
|---|---|
| ECOMP360.1 | Verify the working of different diodes, transistors, CRO probes and measuring instruments. Identifying the procedure of doing the experiment. |
| ECOMP360.2 | Design the circuits with basic semiconductor devices (active & passive elements), measuring instruments & power supplies that serve many practical purposes. |
| ECOMP360.3 | Construct, analyze and troubleshoot the designed circuits. |
| ECOMP360.4 | Measure and record the experimental data, analyze the results, and preparea formal laboratory report. |

**Part B: Digital Electronics**

Upon completion of the course, students will be able to

| | |
|---|---|
| ECOMP360.5 | Verify the working of basic gates and Universal gates |
| ECOMP360.6 | Apply Boolean laws to simplify and implement digital circuits |
| ECOMP360.7 | Design and implement combinational circuits and Sequential circuits |
| ECOMP360.8 | Verify the operation of counters, shift registers |

**Note: At least 10 experiments should be conducted from Part A and B. (Suggestion: Conduct first five from Part A and Part B for better understanding of the course)**

**Part A: Analog Electronics**

1. **Analysis and Design Filters**
2. **Analysis and Design Amplifiers using BJT (Class A/B/C/ Push Pull)**
3. **Analysis and Design Oscillators (RC & LC/ Colpitt / Hartley)**
4. **Analysis and Design of Multivibrators (Monostable/ Astable / Bistable) using BJT**
5. **Analysis of Integrators and Differentiators**
6. Design RC-coupled Amplifier
7. Design Transformer coupled Amplifier
8. MOSFET biasing circuits
9. Design Schmitt trigger using BJT

**Part B: Digital Electronics**

1. **Study of Logic Gates and Performance of Universal Gates**
2. **Realization of Boolean expressions in SOP & POS forms**
3. **Half Adder, Full Adder**
4. **Multiplexer& Demultiplexer**
5. **Study of SR & JK Flip-Flop and conversion of one FF to another**
6. Design of Combinational Logic Circuits
7. Half Subtractor, Full Subtractor
8. BCD Adder
9. Encoder &Decoder
10. Magnitude Comparator
11. Parity generators and checkers
12. Code converters
13. Ring & Twisted Ring Counter
14. Binary Asynchronous Counter
15. Synchronous UP/DOWN Counter Design
16. SISO, SIPO Shift register
17. Universal Shift Register

The total marks for the practical exam are 25. Following guidelines can be followed for conducting the practical examination to maintain the uniformity across the colleges under the GOA University.

- Question1 from PART A (10 Marks)
- Question2 from PART B (10 Marks)
- Viva (05 Marks)
- Submission of practical file is mandatory

## ECOMP 370 Data Structures and Algorithms using C++ Lab

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| ECOMP 370 | Data Structures and Algorithms using C++ Lab | – | – | 2 | - | - | - | – | 25 | – | 25 | 1 |

**Course Objective:**

The course aims to provide the student with:

1. Ability to understand the generic principles of object oriented programming using C++.
2. An ability to plan, design, execute and document sophisticated object oriented programs to handle different computing problems
3. An ability to use data structures as the foundational base for computer solutions to engineering problems.
4. An ability to plan, design, execute and document sophisticated technical programs to handle various sorts of data structures using object oriented principles

**Course Outcome:**

Upon completion of the course, students will be able to

| | |
|---|---|
| ECOMP370.1 | Implement the concepts of classes, objects, friend function, Constructor and Destructor |
| ECOMP370.2 | Implement the concepts of polymorphism, Inheritance, Templates and Exception Handling |
| ECOMP370.3 | Implement linked lists, stacks and queues |
| ECOMP370.4 | Implement searching and sorting techniques. |

**List of Experiments:**

**Note: At least 10 experiments should be conducted from the list of experiments.**

1. Classes and objects
2. Function overloading
3. Operator Overloading
4. Constructor and Destructors
5. Friend function and friend classes
6. Inheritance
7. Templates
8. Implementation of singly/doubly/circular linked list
9. Implementation of stack using array/ linked list
10. Implementation of queue using array/linked list

11. Implementation of sorting technique
12. Implementation of searching technique

The total marks for the practical exam are 25. Following guidelines can be followed for conducting the practical examination to maintain the uniformity across the colleges under the GOA University.

- Question1 can be easy (10 Marks)
- Question2 can be difficult (10 Marks)
- Viva (05 Marks)
- Submission of practical file is mandatory

## HM012 Technical Writing and Professional Communication

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| HM012 | Technical Writing and Professional Communication | 1 | 1 | – | -- | -- | -- | 75 | – | – | 75 | 2 |

**Course Objective:**

The course aims to:

1. Acquaint the students with basic concepts, process of technical communication
2. Enhance communication skills by giving adequate exposure in Listening, Speaking, Reading, and Writing skills
3. Improve effective communication and interpersonal skills in life and at workplace
4. Build multidisciplinary approach towards all life tasks and life learning

**Course Outcome:**

Upon completion of the course, students will be able to

| | |
|---|---|
| HM012.1 | Demonstrate precise language skills with suitable vocabulary and apt style |
| HM012.2 | Develop life skills/interpersonal skills to progress professionally |
| HM012.3 | Apply traits of suitable candidature for a job/higher education |
| HM012.4 | Deliver formal presentations and effectively implementing the verbal and non-verbal communication. skills |

| **UNIT-1 Communication Foundations And Analysis** | |
|---|---|
| Process of Communication, Importance of Listening, Speaking, Reading, Writing, Principles of Communication, Overcome Barriers to Communication, Conversational Skills, Organizational Communication, Culture and Communication, Communicating Electronically – Webpage Communication, Voice and Wireless Communication, Email Communication, Group Communication – Characteristics of Effective Groups, From Groups to Teams, Group Discussion, Meeting Management, Technical Writing - Elements of Effective Writing, Grammar – Framework of English, Architecture of Sentence, Common Problems with English, Technical Reports, Technical Proposals, Formal Letters, Research Papers, and Technical Descriptions | **11 Hrs.** |
| **UNIT-2 Personality Development** | |
| SWOC Analysis, Emotional Intelligence, Leadership, Time Management, Motivation. Goal Setting, Teamwork and Collaboration, Critical Thinking and Problem Solving, Professional Attitude, Persuasion, Anxiety and Stress Management, Social Responsibility | **3 Hrs.** |
| **UNIT-3 Career Development** | |

| | |
|---|---|
| Career Plan, Job Application Letter, Resume Building, Interviewing Skills, Personal Networking and Branding, Build Professional Portfolio | **7 Hrs.** |
| **UNIT-4 Public Speaking** | |
| Build Confidence and Overcome Nervousness, Use of Visual Aids, Craft and Impactful Speech, Design and Deliver Impactful Presentations | **5 Hrs.** |

| **Term Work** | | |
|---|---|---|
| **Type of Activity** | **Number** | **Marks allotted** |
| Assignments | 08 | 75 |
| **Total** | | **75** |

| **Tutorials** | | |
|---|---|---|
| **Unit and Topic** | **Hours** | **Marks allotted as Term Work** |
| 01: Group Discussion | 05 | 10 |
| 03: Interview Skills (Mock Interviews) | 05 | 10 |
| 04: Presentations | 03 | 10 |

| **Assignments** | | | |
|---|---|---|---|
| **Unit Number and Topic** | **Sub-Topic** | **Number of Assignments** | **Marks allotted** |
| 01: Communication Foundations and Analysis | Email Writing<br>**Group Discussion**<br>Proposal Writing<br>Report Writing | 1<br>1<br>1<br>1 | 05<br>**10**<br>10<br>10 |
| 02: Personality Development | SWOC Analysis | 1 | 10 |
| 03: Career Development | Resume Building<br>**Interviews Skills** | 1<br>1 | 10<br>**10** |
| 04: Public Speaking | **Presentations** | 1 | **10** |
| | **Total** | **08** | **75** |

*Note: The topics marked in bold are assignments to be done during Tutorials.

| **TEXT BOOKS** | |
|---|---|
| 1 | Technical Writing and Professional Communication for non-native speakers of English. Thomas N. Huckin and Leslie A. Olsen. McGraw Hill |
| 2 | Technical Communication – Principles and Practice. Meenakshi Raman and Sangeeta Sharma. Oxford University Press. 2016. 3rd Edition |
| 3 | BCOM. Lehman, Dufrene, Sinha. Cengage Learning. 2016. 2nd Edition |
| 4 | Personal Development for Life and Work. Masters and Wallace. Cengage Learning. 2012. 10th Edition |
| 5 | Mastering Communication. Nicky Stanton. Palgrave Master Series. 2009. 5th Edition |
| 6 | Communication Skills. Meenakshi Raman and Sangeeta Sharma. Oxford University Press. 2017. 2nd Edition |
| 7 | Effective Technical Communication. Ashraf Rizvi. Tata McGraw Hill. 2014 |

**Semester IV**

**ECOMP 410 Mathematics IV**

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| ECOMP 410 | Mathematics IV | 3 | 1 | – | 4 | 100 | 25 | 25 | – | – | 150 | 4 |

**Course Objective:**

1. To build the strong foundation in the field of Mathematics needed for the field of Electronics and computer Engineering.
2. To acquire the knowledge of Computation techniques and its applications.
3. To develop the solutions using the mathematical logic and the graph theory techniques

**Course Outcome:**

Upon completion of the course, students will be able to

| | |
|---|---|
| ECOMP 410.1 | Apply the concepts of sets, functions and congruence in their engineering problems |
| ECOMP 410.2 | Solve various problems using Logic and the proofing techniques |
| ECOMP 410.3 | Demonstrate problem solving using different counting techniques |
| ECOMP 410.4 | Investigate problems & arriving decisions using Binomial distribution, Poisson distribution, Uniform distribution, Normal distribution and Exponential distribution |
| ECOMP 410.5 | Make decisions using large sampling testing- Z-test for proportion, mean and variance |

| **UNIT-1 Sets, Relation & Functions and Integers** | |
|---|---|
| **Set Theory:** Sets, Set Operations, **Relations and their properties**, Equivalence Relations, partial orderings, Posets.<br>**Functions:** One-to-One and Onto Functions, Inverse Function, Composition of functions, some important functions in computer science.<br>**Integers:** Integers and division (excluding applications of congruences and cryptology), primes and greatest common divisors, Euclid's algorithms for computing g.c.d. Congruences-Linear Congruence, Chinese reminder theorem, Fermat's little theorem. | **10 Hrs.** |
| **UNIT-2 Propositional Calculus, Boolean Algebra and Method of Proofing** | |
| **Propositional Calculus:** Propositional logic, propositional equivalences, predicates and quantifiers (with one variable only), rules of inference.<br>**Boolean Algebra:** Basic Operations, Boolean functions, Sum of Product and Product of sums form, Normal Forms, Canonical Form.<br>**Mathematical Induction:** Principle of Mathematical Induction and applications | **9 Hrs.** |
| **UNIT-3 Counting Techniques** | |

| | |
|---|---|
| **Counting:** The basics of counting, permutations and combinations, binomial coefficients, pigeonhole principle.<br>**Advanced Counting Techniques:** Inclusion-exclusion principle, applications of inclusion-exclusion principle, generating functions, and Recurrence relations, solving linear recurrence relations using iteration method, characteristic roots and generating functions | **10 Hrs.** |
| **UNIT-4 Probability and Statistical Inference theory** | |
| Review of Probability theory. **Random variables**- Discrete random variable and continuous random variable, moments, moment generating function (MGF), distribution function (CDF), Standard Distributions-Binomial Distribution, Poisson Distribution, Uniform distribution, Normal Distribution, and Exponential distribution.<br>**Sampling Theory**, Large Sample tests - Z-test for proportion, mean and standard deviation | **10 Hrs.** |

| **TEXT BOOKS** | |
|---|---|
| 1 | J. P. Tremblay and R. Manohar, McGraw Hill; Discrete Mathematical Structures with Applications to Computer Science; New York McGraw Hill |
| 2 | Kenneth H. Rosen; Discrete Mathematics and Its Applications; Tata McGraw Hill (6th edition). |
| 3 | Ronald E. Walpole, Raymond H. Myers; Probability & Statistics for Engineers & Scientists (9th edition), Pearson Education Limited |

| **REFERENCES** | |
|---|---|
| 1 | Swapan Kumar Sarkar; Discrete Mathematics; S. Chand Publication |
| 2 | Dr. D. S. C; Discrete Mathematical Structures; Prism Books Pvt. Ltd |
| 3 | Murray R. Spiegel, Larry J. Stephens; Theory and problems of Statistics |

## ECOMP 420 Computer Organization and Architecture

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| ECOMP 420 | Computer Organization and Architecture | 3 | 1 | – | 4 | 100 | 25 | 25 | – | – | 150 | 4 |

**Course Objective:**

1. To understand the structure, function and characteristics of computer systems
2. To identify the elements of instructions sets and their impact on processor design.
3. To explain the function of each element of a memory hierarchy
4. To identify and compare different methods for computer I/O.

**Course Outcome:**

Upon completion of the course, students will be able to

| | |
|---|---|
| ECOMP420.1 | Identify high performance architecture design and perform different computer arithmetic operations |
| ECOMP420.2 | Create an assembly language program to program a microprocessor system |
| ECOMP420.3 | Categorize memory hierarchy and its impact on computer cost/performance |
| ECOMP420.4 | Design a pipeline for consistent execution of instructions with minimum hazards |
| ECOMP420.5 | Articulate design issues in the development of Multiprocessor organization & architecture |

| UNIT-1 | |
|---|---|
| **Introduction to Computer Organization:** Computer components, Functions, interconnection Structure, Bus Interconnection, Register organization, Instruction Cycle<br>**Computer Arithmetic:** Integer Arithmetic: Addition, Subtraction, Multiplication unsigned, signed (Booths Algorithm), Division- unsigned, signed. Floating-Point Representation: IEEE 32 bits, 64 bits. Floating-Point Arithmetic: Addition, Subtraction, Multiplication, Division. | **10 Hrs.** |
| **UNIT-2** | |
| **Microprocessors:** Organization of Microprocessor-Based system, Pin description and Internal architecture of Intel 8085A microprocessor: 8085 Programming model<br>**Programming the 8085:**<br>8085 Machine Cycles and Bus Timings: Opcode fetch, memory and I/O read/write Instruction Set and ALP: Addressing modes; Data transfer operations, arithmetic operations, logic operations, branch operations, Counters and time delays. | **10 Hrs.** |
| **UNIT-3** | |

| | |
|---|---|
| **Memory System:** Basic concepts, Characteristics, Hierarchy, Semiconductor RAM Memories, Internal Organization of Memory Chip, Read-Only Memories. Cache Memory Principles, Elements of Cache Design, Mapping functions, Replacement Algorithm, Virtual Memories.<br>**Input/Output:** External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access | **10 Hrs.** |
| **UNIT-4** | |
| **Instruction Pipelining:** Strategy, Performance and Hazards, RISC CPU **Architecture:** Instruction Execution Characteristics, Use of Large Register File, Compiler based register optimization, Reduced Instruction Set Architecture, RISC v/s CISC<br>**Control Unit Operation:** Micro Operations, Control of the CPU, Hardwired Implementation.<br>**Micro programmed Control:** Basic Concepts, Microinstruction Sequencing, Microinstruction Execution. | **9 Hrs.** |

| **TEXTBOOKS** | |
|---|---|
| 1 | William Stalling, "A textbook of Computer Organization and Architecture", Edition VI |
| 2 | Carl Hamacher, Zvonko Vranestic, Safwat Zaky, "Computer Organization", Edition V, McGraw-Hill |
| 3 | David A. Patterson, John L. Hennesy, "Computer Organization And Design", Edition III |
| 4 | Gaonkar R. S., "Microprocessor Architecture, Programming and Applications", Edition V, Penram International, 2007 |

| **REFERENCE BOOKS** | |
|---|---|
| 1 | Tannenbaum, "Structured Computer Organization", Pearson Education, 2002 |
| 2 | Douglas V. Hall, Microprocessors and Interfacing |
| 3 | M. Morris Mano ; A textbook of Computer Organization and Architecture |

## ECOMP 430 Analog Circuit Design

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| ECOMP 430 | Analog Circuit Design | 3 | 1 | – | 4 | 100 | 25 | 25 | – | – | 150 | 4 |

**Course Objective:**

This course introduces the theoretical & circuit aspects of Op-amp, which is the backbone for the basics of Analog circuits.

**Course Outcome:**

Upon completion of the course, students will be able to

| | |
|---|---|
| ECOMP430.1 | Infer the DC and AC characteristics of operational amplifiers and its effect onoutput and their compensation techniques |
| ECOMP430.2 | Explain and design the linear and non-linear applications of an opamp and special application ICs |
| ECOMP430.3 | Explain and compare the working of multivibrators using special application IC 555 and general purpose opamp |
| ECOMP430.4 | Illustrate the function of application specific ICs such as Data Converters, Voltage Regulators, OLL and its application in communication |

| UNIT-1 | |
|---|---|
| **Differential Amplifiers:** Differential amplifiers, ac and dc analysis, FET differential amplifier, constant current bias, current mirror circuit.<br>**Basics of Op-Amp:** Functional block diagram of Op-amp,op-amp parameters, definitions, measurements, equivalent circuit of Op-amp and voltage transfer curve, open loop inverting, non- inverting, differential amplifier. Disadvantages of open loop op-amp<br>Frequency response and methods of frequency compensation, offset compensation, closed loop inverting and non-inverting amplifiers, voltage follower, V-I & I-V converter<br>**Applications of op-amp:** Differentiator, integrator, summing scaling and averaging amplifier | **9 Hrs.** |
| **UNIT-2** | |
| **Applications of Op-Amp**<br>Instrumentation amplifier, precision rectifier, log and antilog amplifier. Op-Amps as comparators, zero crossing detectors, Schmitt trigger, comparator characteristics, limitations of comparator, sample and hold circuit.<br>Advantages of active filter, Butterworth low pass, high pass, band pass, band reject filter, design problems.<br>Square wave generator, triangular wave generator, Wien bridge oscillator, Phase shift oscillators, design problems | **10 Hrs.** |

| UNIT-3 | |
|---|---|
| **Voltage Regulators:**<br>Specifications & functional block diagrams of IC 723, Design of IC 723 as high and low voltage regulators.<br>Specifications& working of three terminal regulators-IC78XX, 79XX, LM309, LM317 voltage regulator, principle and working of switching mode regulators, tracking regulator<br>Introduction to resolution and accuracy in convertors, quantization error.<br>**ADC and DAC:** Principle of successive approximation, successive approximation ADC. Binary weighted resistors and R-2R resistor ladder design problems, specifications, functional block diagrams of 0809 & 0808. Flash types ADCs | **10 Hrs.** |
| **UNIT-4** | |
| **Voltage controlled oscillator IC566:** block diagram of IC566.<br>**PLL:** Basic principles of phase-locked loop and block diagram, transfer characteristics of PLL, lock range and capture range (no derivations). Applications of PLL as frequency multiplier, AM demodulation, FM demodulation, Study of PLL IC 565 and design problems.<br>**IC 555:** Functional block diagram and specification, modes of IC 555, applications of IC 555 as monostable and astable multivibrator, design problems, modification for 50% duty cycle. Applications of IC 555 as VCO, missing pulse detector, frequency divider, PWM,<br>**IC 8038** and its applications in waveforms generation. | **10 Hrs.** |

| TEXTBOOKS | |
|---|---|
| 1 | Ramakant A. Gayakwad; Op-Amps and linear integrated circuits; Pearson 2015 |
| 2 | K. R. Botkar; Integrated Circuits; Khanna Publishers.2004 |

| REFERENCE BOOKS | |
|---|---|
| 1 | J. Millman, C. Halkias, C. Parikh; Integrated Electronics: Analog and Digital Circuits and Systems; 2ed, McGraw Hill. 2017 |
| 2 | S. Franco; Design with operational amplifiers and analog integrated circuits; 3ed McGraw Hill. 2001 |
| 3 | Tony Chan Carusone, David Johns, Kenneth Matins; Analog Integrated Circuit |
| 4 | Design; 2e, John Wiley & Sons, 2013 |
| 5 | Gray Paul R., Meyer, Hurst, Lewis; Analysis and Design of Analog Integrated Circuits; 5ed, Wiley India Pvt Ltd |
| 6 | K. Michael Jacob; Applications and Design with Analog Integrated Circuits; 2ed, PHI |
| 7 | S. Salivahana, V.S.K. Bhaskara, Linear Integrated Circuits, Mc Graw Hill |

Note: Term work of Analog circuits may be carried out using the reference NPTEL course given below
https://archive.nptel.ac.in/content/syllabus_pdf/117108038.pdf

## ECOMP 440 Database Management Systems

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| ECOMP 440 | Database Management Systems | 3 | – | – | 3 | 100 | 25 | – | – | – | 125 | 3 |

**Course Objective:**

1. Introduction of basics of database management system like SQL, ER model, transaction processing- concurrency control for effective database design
2. Understand use of the latest technology in database systems with schemaless versions to cater growing demand of modern applications

**Course Outcome:**

Upon completion of the course, students will be able to

| | |
|---|---|
| ECOMP440.1 | Demonstrate fundamentals of data models and to represent a database system using ER diagrams |
| ECOMP440.2 | Device SQL and normalization techniques in database application |
| ECOMP440.3 | Apply transaction processing & concurrency control mechanism for database problems |
| ECOMP440.4 | Analyze how advanced schema less databases differ from traditional databases |

| UNIT-1 | |
|---|---|
| **Introduction:** Characteristic of Database approach, advantages of using the DBMS approach, Three schema architecture, Data Models.<br>**Entity–Relationship Model:** Entity –Relationship Model, Constraints, removing redundant attribute in entity set, Entity-Relationship diagram.<br>**The Relational Model:** Relational model concepts, Constraints, and relational Database schema<br>**Relational Algebra:** Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set theory<br>**Binary Relational Operations:** JOIN and DIVISION, Aggregate functions, and Grouping. | **9 Hrs.** |
| **UNIT-2** | |
| **Extended ER Model:** Reduction to relational schema, Extended-ER features.<br>**Basic SQL:** SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT, DELETE and UPDATE statements in SQL. | **10 Hrs.** |

| | |
|---|---|
| **More SQL:** Complex Queries, Nested Queries, Aggregate Operators, Views, Specifying Constraints as Assertions and Actions as Triggers.<br>**Relational Database Design:** Informal design guidelines for relational schemas, Functional dependencies, Normal forms: 1NF, 2NF, 3NF, BCNF. | |
| **UNIT-3** | |
| **Query Processing and Optimization:** Translating SQL queries into Relational Algebra, Query Trees and Heuristics in Query Optimization.<br>**Transaction processing concepts:** Concepts of transaction processing, ACID properties, characterizing schedules based on recoverability, characterizing schedules based on serializability.<br>**Concurrency Control:** Two phase locking technique for concurrency control. | **10 Hrs.** |
| **UNIT-4** | |
| **Getting Started with NoSQL:** About NoSQL, Why NoSQL?, SQL versus NoSQL, ACID versus BASE, CAP Theorem<br>**Introduction to different types of NoSQL Databases:** Key−Value Pair Databases, Document Databases, Column-Family Databases, Graph Database<br>**MongoDB:** Introduction, Getting Started with MongoDB Storage Engines in MongoDB, Managing and Administering MongoDB, Shell Methods, Data Types, CRUD Operations, MongoDB Intermediate Concepts, MongoDB Indexes, MongoDB Query Selectors. Aggregation, Sharding & Replication in MongoDB | **10 Hrs.** |

| **TEXTBOOKS** | |
|---|---|
| 1 | "Fundamental of Database systems", Elmasri Ramez, Navathe Shamkant 7th Edition Pearson 2018 ISBN:-978-8131716250 |
| 2 | "Database system concepts", Abraham Silberschatz, Henry F.korth, S. Sudarshan 6th edition, McGraw Hill, 2013 |

| **REFERENCE BOOKS** | |
|---|---|
| 1 | "Demystifying NoSQL", Seema Acharya, ISBN: 9788126579969, WILEY, 2019 |
| 2 | "MongoDB Complete Guide", Manu Sharma, BPB Publications |

## ECOMP 450 Java Programming

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| ECOMP 450 | Java Programming | 3 | – | – | 3 | 100 | 25 | – | – | – | 125 | 3 |

**Course Objective:**

1. To learn designing and development of JAVA applications using OOP concepts
2. To learn back end connection and utilization of schema based as well as schema less databases

**Course Outcome:**

Upon completion of the course, students will be able to

| | |
|---|---|
| ECOMP450.1 | Write programs using basic features of Java and demonstrate the use of classes, object, packages and collection framework using Java |
| ECOMP450.2 | Illustrate and implement exception handling, multithreading and event handling |
| ECOMP450.3 | Utilize JAVA collection Framework and filesystem object |
| ECOMP450.4 | Design interface with Java Database Connectivity and create enterprise applications using components of J2EE |

| UNIT-1 | |
|---|---|
| **Introduction to JAVA:** Java and Java applications; Java Development Kit (JDK) Byte Code, JVM; Object-oriented programming<br>**Simple Java programs:** Data types and other tokens: Boolean variables, int, long, char, operators, arrays, white spaces, literals, assigning values; Creating and destroying objects; Access specifiers. Operators and Expressions: Arithmetic Operators, Bitwise operators, Relational operators, The Assignment Operator, Ternary Conditional Operator; Operator Precedence; Logical expression; Typecasting; Strings.<br>**Control Statements:** Selection statements, iteration statements, Jump Statements.<br>**Classes, Inheritance, Exceptions:** Classes: Classes in Java; Declaring a class; Class name; Super classes; Constructors; Creating instances of class; Inner classes. Inheritance: Simple, multiple, and multilevel inheritance; Overriding, overloading, Exception handling in Java.<br>**Java Packages:** Creating a Package, The import Keyword, The Directory Structure of Packages, Set CLASSPATH System Variable. | **10 Hrs.** |
| **UNIT-2** | |
| **Multi-Threaded Programming:** Multi-Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, readwrite problem, producer-consumer problems. | **10 Hrs.** |

| | |
|---|---|
| **Event Handling:** Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.<br>**Swings:** The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField;The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable; Jframes | |
| **UNIT-3** | |
| **Java Collection Framework:** Interfaces (Set, List, Queue, Deque), ArrayList, Vector, LinkedList, PriorityQueue, HashSet, LinkedHashSet, TreeSet; Lambda Expressions **Files and Streams:**Stream, Standard Streams, Reading and Writing Files, ByteArrayInputStream, DataInputStream, FileOutputStream, ByteArrayOutputStream, DataOutputStream, Navigation and I/O, Working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects | **10 Hrs.** |
| **UNIT-4** | |
| **JAVA 2 Enterprise Edition Overview, Database Access:** Overview of J2EE and J2SE. The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions. **Servlets:** Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. **JSP:** Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects | **9 Hrs.** |

| **TEXTBOOKS** | |
|---|---|
| 1 | "Java The Complete Reference", Herbert Schildt, McGraw Hill; Eleventh edition, 2020 |
| 2 | "Programming with Java", E. Balagurusami, McGraw-Hill; Sixth edition, 2019 |

| **REFERENCE BOOKS** | |
|---|---|
| 1 | "J2EE - The Complete Reference", Jim Keogh, Tata McGraw Hill. |
| 2 | "Core Java Volume 1: Fundamentals", Cay S. Horstmann, Oracle Press, 12th edition. |
| 3 | "Introduction to JAVA Programming", Y. Daniel Liang, Pearson Education, 6th Edition. |

## ECOMP 460 JAVA and DBMS Lab

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| ECOMP 460 | JAVA and DBMS Lab | – | – | 2 | - | - | - | – | 25 | – | 25 | 1 |

**Course Objective:**

The course aims to provide the student with:

**PART A:**

1. To use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
2. To design and develop JAVA program to solve real life problems

**PART B:**

1. To introduce basic database concepts, applications, data models, schemas and instances
2. To train students in Database designing and implementation considering application requirement

**Course Outcome:**

Upon completion of the course, students will be able to

**PART A:**

| | |
|---|---|
| ECOMP 460.1 | Learn and implement basic JAVA programs adhering OOP concept |
| ECOMP 460.2 | Apply concepts of Inheritance, exception handling, multithreading & event handling to solve real example |
| ECOMP 460.3 | Utilization of JAVA collection Framework & files and streams using Java |
| ECOMP 460.4 | Design interfaces using Swing Classes with Java Database Connectivity |

**PART B:**

| | |
|---|---|
| ECOMP 460.5 | Apply the basic concepts of Database Systems and Applications |
| ECOMP 460.6 | Use the basics of SQL and construct queries using SQL in database creation and interaction. |
| ECOMP 460.7 | Design and implement backend storage for semi structured and unstructured data using MongoDB |
| ECOMP 460.8 | Implement Aggregation, Indexing and querying techniques and to connect MongoDB given an application |

**List of Experiments:**

**Note: At least 10 experiments should be conducted from Part A and B.**

**PART A: JAVA**

1 Simple Programs in Java (2-3 programs)

2 Simulation of Constructors in Java
3 A program to demonstrate Inheritance in Java
4 A program to demonstrate Multithreaded Programming in Java
5 A program to demonstrate Exceptions and Event Handling in Java
6 A mini application using SWINGS in Java
7 A program with utilization of Java Collection Framework
8 A program to demonstrate importance of Files and Streams
9 A program to demonstrate JDBC/ODBC connectivity and its use
10 A program to demonstrate Servlets and JSP
11 Implementation of Java Web Based(Mini-Project)
12 A program to demonstrate connectivity and data movement using MongoDB

**PART B: Database Management Systems**

1 To study Data Definition language Statements and Data Manipulation Statements.
2 Study of SELECT command with different clauses
3 Study of GROUP functions (avg, count, max, min, Sum).
4 Study of various type of SET OPERATORS (Union, Intersect, Minus).
5 Study of Various type of JOINS
6 To study Views, Triggers and Procedures
7 Implement database with suitable example using MongoDB and implement all basic operations and administration commands using two tier architecture
8 Use MongoDB to process semi structured and unstructured data collections such as Rfid, images, blogs use Python/Java/Any suitable language MongoDB interface.
9 Aggregation and indexing with suitable example using MongoDB.
10 Indexing and querying with MongoDB using suitable example.
11 Connectivity with MongoDB using any Java application.

The total marks for the practical exam are 25. Following guidelines can be followed for conducting the practical examination to maintain the uniformity across the colleges under the GOA University.

- Question1 from PART A (10 Marks)
- Question2 from PART B (10 Marks)
- Viva (05 Marks)

Submission of practical file is mandatory

## ECOMP 470 Analog Circuits Design Lab

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| ECOMP 470 | Analog Circuits Design Lab | – | – | 2 | - | - | - | – | 25 | – | 25 | 1 |

**Course Objective:**

1. To apply operational amplifiers in linear and nonlinear applications.
2. To acquire the basic knowledge of special function ICs

**Course Outcome:**

Upon completion of the course, students will be able to

**PART A:**

| | |
|---|---|
| ECOMP 470.1 | Understand the working of op-amp and its applications |
| ECOMP 470.2 | Design and analyze various linear and non-linear application circuits of op-amp |
| ECOMP 470.3 | Construct and trouble shoot op amp circuits in the laboratory with proper use of test equipment. |
| ECOMP 470.4 | Develop IC based project kits in above areas according to specifications |

**List of Experiments**

**Note: At least 10 experiments should be conducted from the following list of experiments**

1. Current mirror circuit
2. Op-amp open loop inverting and non-inverting circuit
3. Op-amp closed loop Inverting and Non-Inverting amplifier
4. Op-amp: Differentiator, Integrator
5. Op-amp: Summing, Scaling and Averaging amplifier
6. Op-amp: Instrumentation amplifier
7. Op-amp Schmitt Trigger and Monostable Multivibrator
8. Binary Weighted &R-2R Ladder type D- A Converter using op-amp.
9. Op-amp: Square wave generator, triangular wave generator
10. Active HP, LP and BP filter using op-amp
11. RC Phase Shift and Wein Bridge oscillator using op-amp
12. Astable and Monostable Multivibrator using IC 555
13. PLL Characteristics

The total marks for the practical exam are 25. Following guidelines can be followed for conducting the practical examination to maintain the uniformity across the colleges under the GOA University.

- Question1 can be easy (10 Marks)
- Question2 can be difficult (10 Marks)
- Viva (05 Marks)

Submission of practical file is mandatory

## HM013 Business Economies and Management

| Course Code | Name of the Course | Scheme of Instruction Hrs. / week | | | Theory Exam Duration | Scheme of Examination | | | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Marks | | | | | Total | |
| | | L | T | P | | TH | S | TW | P | O | | |
| HM013 | Business Economics and Management | 3 | – | – | 3 | 100 | 25 | – | – | – | 125 | 3 |

**Course Objectives:**

1. To expose students to basic Economic concepts and inculcate an analytical approach to the subject matter
2. To apply economic reasoning to problems of business
3. To be able to recognize, formulate and analyze cash flow models in practical situations
4. To familiarize the students with the basic principles of management
5. To acquaint the students with standard concepts that they are likely to find useful in their profession when employed
6. To be able to understand the various concepts in Ethics

**Course Outcome:**

Upon completion of the course, students will be able to

| | |
|---|---|
| HM013.1 | Understand and apply the basic principles of economics and national income terms |
| HM013.2 | Apply the basic financial concepts and analyse different financial statements to make sound business decisions |
| HM013.3 | Evaluate different management concepts |
| HM013.4 | Apply managerial concepts to solve complex problems related to global issues |

| UNIT-1 | |
|---|---|
| **Introduction and General Concepts:** Demand and Supply- Demand curve, Supply curve, Market Equilibrium<br>**Estimation/Forecasting of Demand:** Meaning, importance, methods– trend, exponential smoothing, regression analysis<br>**National Income Terms:** GDP, Real v/s Nominal GDP, Net Domestic Product, GNP, National Income, Per capita income, Disposable Income, Price Index, Inflation | **9 Hrs.** |
| **UNIT-2** | |
| Preparation of Income statement, Balance sheet. | **10 Hrs.** |

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| Understanding and analyzing them using financial ratios – liquidity, leverage and profitability ratios.<br>**Capital Budgeting:** Different Methods of Evaluation of Projects- Payback Period, Discounted Cash Flow methods- Net Present Value.<br>**Working Capital Management:** Determinants of working capital, financing of working capital, dangers of excessive and shortage of working capital.<br>Break even Analysis | |
| **UNIT-3** | |
| **General Principles of Management:** Introduction to Management, Functions of a manager.<br>**Planning:** Importance of planning, types of plans.<br>**Controlling:** Basic control process, Critical control points and standards<br>Human Resource Management and Selection, Definition of Staffing, Overview of the staffing function, Selection process.<br>**Appraising and Rewarding Performance**: Money as a means of Rewarding Employees, performance appraisal, the Reward Pyramid MBO Process, How to set objectives, benefits and weaknesses, Span of management , Factors determining an effective span, Organization, Structure of organization, Formal and informal organization, Depart mentation, Matrix Organization, Strategic Business Unit Decentralization and Delegation.<br>**Leadership:** Ingredients of leadership, Managerial grid. | **10 Hrs.** |
| **UNIT-4** | |
| **Communication:** Nature and Importance of Communication, The Two-Way Communication Process, Communication Barriers , Downward and Upward Communication/ Formal Informal Communication, Forms of communication.<br>**Motivation:** Model of Motivation, Motivational Drives, Human Needs, Types of Needs, Maslow's Hierarchy of Needs, Hezberg's Two-Factor Theory.<br>**Managing Change:** Nature of Work Change, three Stage in Change<br>**Engineering Ethics:** Engineering Ethics, Self-interest, Customs and Religion.<br>Interpersonal Behavior: Nature and Levels of Conflict, Sources of Conflict, Effects of Conflict, Model of Conflict: Participant Intentions, Resolution Strategies.<br>Whistle – Blowing<br>**Safety Responsibility and Rights:** Responsibility of Engineers, Risk-Benefit Analysis, Ethical issues in Cost-benefit Analysis, Ethics and Risk Management, Reducing Risk | **10 Hrs.** |

| **TEXTBOOKS** | |
|---|---|
| 1 | P.A. Samuelson & W.D. Nordhaus, Economics, 19th Edition McGraw Hill, New York, 1995 |
| 2 | P. C. Tripathi, P. N. Reddy; Principles of Management; 2nd edition, Tata McGraw Hill; 1991. |
| 3 | R. L. Varshney, K L Maheswari; Managerial Economics; Nineteenth, Revised and Enlarged Edition; Sultan Chand and Sons Publications |
| 4 | Prasanna Chandra; Fundamentals of Financial Management; Third Edition, Tata McGraw-Hill, NewDelhi |

| **REFERENCE BOOKS** | |
|---|---|
| 1 | John W. Newstrom, Keith Davis; Organizational Behavior (Human Behavior at Work); Tenth Edition, Tata McGraw Hill |

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| 2 | A. Alavudeen, R. Kalil Rahman and M. Jayakumaran; Professional Ethics and Human Values; Laxmi Publications |
| 3 | Richard M. Lynch, Robert W. Williamson; Accounting for Management, Planning and Control; Third Edition, Tata McGraw-Hill, New Delhi |
| 4 | C. B Gupta; Management: Theory and Practice; Seventeenth Revised and Enlarged edition; Sultan Chand &Sons |
| 5 | H. Craig Petersen, W. Cris Lewis, Sudhir K. Jain; Managerial Economics; Prentice Hall India |