M.S. Ramaiah University of Applied Sciences

New BEL Road, MSR Nagar, Bangalore – 560054

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

PO, PSO, PEO & CO

Programme: B. Tech. in Mathematics and Computing

Programme Code: 412

Programme Outcome (PO)
Programme Specific Outcome (PSO)
Program Educational Objectives (PEO)
Course Outcomes (CO)

Registrar
M.S. Ramaiah University of Applied Sciences
Bangalore - 560 054

Dean
Faculty of Engineering and Technology
M.S. Ramaiah University of Applied Sciences
Bangalore-560058

Approved in 23rd ACM (Resolution 23.05) held on 15th July 2021

Faculty of Engineering and Technology (FET)

Programme Name: B. Tech. (Computing and Mathematics)

Programme Outcomes (POs)

B. Tech. graduates will be able to:

PO-1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

PO-2. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO-3. Design solutions for complex engineering problems and design system componentsor processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

PO-4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information toprovide valid conclusions

PO-5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineeringactivities with an understanding of the limitations

PO-6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

PO-7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO-8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO-9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PO-10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and giveand receive clear instructions

PO-11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, tomanage projects and in multidisciplinary environments

PO-12. Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

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Bangalore-560058

Programme Specific Outcomes (PSOs)

At the end of the B. Tech. (Mathematics and Computing) Programme, the graduate will be ableto:

PSO-1. Apply principles and best practices in design of efficient algorithms and correctprograms; build reliable, secure and robust software, making use of knowledge of computer architecture, systems software , networking, Web technologies distributed computing

PSO-2. Use knowledge gained in both breadth courses in science and engineering and depthcourses in mathematics and computing, solving problems of relevance to society, industry and R&D in an innovative manner

PSO-3. Engage in lifelong learning by applying knowledge of fields of computer science and refining it and evangelizing applications and technologies to all interested communities

Program Educational Objectives (PEOs)

The objectives of the B. Tech. (Mathematics and Computing) Programme are to:

PEO-1. Provide students with a strong foundation in mathematics and computing along withbreadth and foundational requirement in computing, science, engineering and humanities to enable them to devise and deliver efficient and safe solutions to challenging problems in Computer Science and inter-disciplinary areas

PEO-2. Impart analytic and cognitive skills required to develop innovative solutions for R&D,to build creative, dependable and safe products for Industry based on dynamic societal requirements motivated and nurtured by sound theoretical and practical knowledge of time tested and long lasting principles of computer science, current tools and technologies

PEO-3. Develop managerial and entrepreneurial skills inculcating strong human values alongwith social, interpersonal and leadership skills required for professional success in evolving global professional environments

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 1 (MTB101A)

After the successful completion of this course, the student will be able to:

CO-1. State and discuss basic concepts related to single, two variable calculus and matrix algebra

CO-2. Perform basic operations of matrix algebra and apply them to solve systems of linear equations

CO-3. Solve simple mathematical problems associated with linear algebra, single and two variable calculus

CO-4. Demonstrate competence with the basic ideas of linear systems, independence, bases and dimension, linear transformations, eigenvalues, eigenvectors and diagonalization

CO-5. Solve complex real-world problems associated with linear algebra, single and two variable calculus

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M.S. Ramaiah University of Applied Sciences
Bangalore-560058

Course Outcomes (COs)

Course Title & Code: Engineering Physics and Laboratory (PYB102A)

After the successful completion of this course, the student will be able to:

- **CO-1.** State, explain the concepts of mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser and fiber optics
- **CO-2.** Derive standard relationships in mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser & fiber optics, and interpret them
- **CO-3.** Discuss the applications of mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser and fiber optics
- **CO-4.** Solve problems in mechanics, electrical conductivity, quantum mechanics, crystal structure, material science, laser and fiber optics
- **CO-5.** Plan the experimental set-up, conduct experiments, calculate and plot the graphs to obtain the results and write a laboratory report as per the prescribed format.

Course Outcomes (COs)

Course Title & Code: Engineering Mechanics (CEF101A)

After the successful completion of this course, the student will be able to:

- **CO-1.** State and describe the laws of Statics, Friction and Dynamics and their contexts of application.
- **CO-2.** Interpret standard mathematical relationships and apply for solving simple static and dynamic problems in engineering mechanics
- **CO-3.** Calculate moment of inertia, determine centroid, centre of gravity for the structural members
- **CO-4.** Apply the laws of statics and dynamics for the equilibrium analysis of rigid bodies with and without friction
- **CO-5.** Apply energy methods in analyzing of static and dynamic aspects of engineering structures made of rigid bodies

Course Outcomes (COs)

Course Title & Code: Elements of Electronics Engineering and Laboratory (ECF102A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain working principles of PN junction diode, Zener diode, transistors, amplifier configurations, Op-Amps, power supply, logic gates and electronic displays
- **CO-2.** Derive mathematical relationships for electronic devices and circuits
- **CO-3.** Solve simple numerical and design problems related to analog / digital circuits as well as devices
- **CO-4.** Design and analyse operation of standard analog / digital circuits for a given application
- **CO-5.** Conduct experiments as per the standard procedures and tabulate/calculate/plot the measured values
- **CO-6.** Interpret and compare with standard results, and draw conclusions and Write report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Engineering Drawing (MEF103A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the conventions used in projections of geometric entities and interpret the same
- **CO-2.** Draw orthographic projections for the geometric entities in specified positions
- **CO-3.** Develop lateral surfaces of un-sectioned and sectioned regular solids
- **CO-4.** Develop orthographic projections for given applications
- **CO-5.** Draw isometric projections for the solids and their combinations
- **CO-6.** Demonstrate competency in using CAD tool for drawing projections of geometric entities

Course Outcomes (COs)

Course Title & Code: Constitution, Human Rights and Law (LAN101A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the key principles of the Indian Constitution
- **CO-2.** Explain Indian legal system and judicial structure that govern the citizens
- **CO-3.** Discuss UN Declaration of Human Rights
- **CO-4.** Discuss the scope and application of Human Rights Principles and Law
- **CO-5.** Suggest strategies for protection of human rights and resolving legal issues in compliance with applicable laws

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 2 (MTB102A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the fundamentals of ordinary differential equations and Laplace transform
- **CO-2.** Solve standard forms of ordinary differential equations
- **CO-3.** Solve simple problems in ordinary differential equations and Laplace transform
- **CO-4.** Model real world problems using ordinary differential equations and solve complex problems associated with ordinary differential equations using Laplace transform
- **CO-5.** Apply Laplace transform in solving complex real world engineering problems

Course Outcomes (COs)

Course Title & Code: Engineering Chemistry and Laboratory (CYB104A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the basic concepts of electrochemistry, conversion of chemical energy into electrical energy, theory of corrosion and principles of metal finishing
- **CO-2.** Differentiate renewable - nonrenewable fuels, primary - secondary electrodes & primary -

M.S. Ramaiah University of Applied Sciences Bangalore

Dean
Faculty of Engineering and Technology
M.S. Ramaiah University of Applied Sciences
Bangalore-560058

secondary batteries, batteries - fuel cells, electroplating – electroless plating, thermosetting – thermoplastic polymers and dry corrosion - wet corrosion

CO-3. Discuss the reaction chemistry and stoichiometry of combustion of fuels, remedial measures to control oxides of nitrogen, sulphur and carbon, polymerization – methods, mechanism, preparation, properties and applications of some polymers, concepts of nano science and nanotechnology

CO-4. Identify the types of corrosion and methods to prevent corrosion, suitable polymers and nanocomposite materials for engineering applications

CO-5. CO-5. Derive kinetic rate equations for various chemical systems and equation for electromotive force

CO-6. Analyze the suitability of polymers & composites for various applications and solve problems related to storage devices, chemical kinetics, electro chemistry, corrosion and metal finishing

CO-7. Plan the experimental set up, conduct experiments, calculate and plot the graphs to obtain results, and write a laboratory report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Elements of Mechanical Engineering and Workshop Practice (MEF104A)

After the successful completion of this course, the student will be able to:

CO-1. Demonstrate the understanding on Classification of energy sources, energy conversion systems, mechanical power transmission systems, machine tools and processes

CO-2. Describe various energy conversion systems, mechanical power transmission systems and machine tools

CO-3. Explain the working principle of refrigeration systems, biomass conversion technologies and machining operations

CO-4. Solve numerical problems on IC engines and mechanical power transmission systems

CO-5. Apply principles of energy conversion systems, power transmission systems, machining processes and mechanical joints to practical applications

Course Outcomes (COs)

Course Title & Code: Elements of Electrical Engineering and Laboratory (EEF105A)

After the successful completion of this course, the student will be able to:

CO-1. State and explain various laws of electric circuits, magnetic circuits and their significance, phasor diagrams for electrical elements

CO-2. Explain construction, principle of operation, working and characteristics of DC machines, transformers, AC rotating machines and their applications

CO-3. Derive equations for electrical circuits, magnetic circuits and performance of various AC and DC machines

CO-4. Solve problems on electric circuits, magnetic circuits, DC machines, transformers and AC rotating machines

CO-5. Conduct experiments as per the standard procedures and tabulate/calculate/plot the measured values

CO-6. Interpret and compare with standard results, and draw conclusions and Write report as per the prescribed format

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M.S. Ramaiah University of Applied Sciences
Bangalore-560058

M.S. Ramaiah University of Applied Sciences * Bangalore - 560054 *

Course Outcomes (COs)

Course Title & Code: Elements of Computer Science and Engineering and Laboratory (CSF106A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the elements and methodology of Computer Science and Engineering
- **CO-2.** Explain the basic principles and techniques of algorithms and programming
- **CO-3.** Select appropriate approach to solve a computational problem
- **CO-4.** Design an algorithmic solution and draw a flow chart of the solution
- **CO-5.** Develop computer programs for moderately complex problems
- **CO-6.** Test and validate developed computer programs

Course Outcomes (COs)

Course Title & Code: Professional Communication (TSN101A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Apply the concepts of grammar for communication
- **CO-2.** Compose precise paragraphs
- **CO-3.** Demonstrate professional etiquette
- **CO-4.** Demonstrate appropriate verbal and non-verbal communication in the given context
- **CO-5.** Develop professional written document

Course Outcomes (COs)

Course Title & Code: Complex Analysis and Vector Calculus (MCC201A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain basic concepts in multiple integrals, vector integration and complex plane
- **CO-2.** State and prove important theorems related to multiple integrals, vector integration, analytic functions, and complex integration in C
- **CO-3.** Solve simple problems related to multiple integrals, vector integration, analytic functions, power series and complex integration
- **CO-4.** Model real world problems using multiple integrals, vector integration and properties of analytic functions
- **CO-5.** Solve complex problems related to multiple integrals, vector integration, analytic functions, power series and complex integration

Course Outcomes (COs)

Course Title & Code: Probability and Statistics (MCC202A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the basic concepts and techniques of Probability and Statistics.

M.S. Ramaiah University of Applied Sciences * Bangalore - 560054 *

Dean
Faculty of Engineering and Technology
M.S. Ramaiah University of Applied Sciences
Bangalore-560058

CO-2. Explain the principles and applications of basic probability models and statistical techniques
CO-3. Develop probabilistic and statistical models for a given application
CO-4. Solve and analyse probabilistic and statistical models
CO-5. Apply probability models and statistical techniques to solve a complex problem

Course Outcomes (COs)

Course Title & Code: Discrete Mathematics (CSC201A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the concepts and theories of sets, logic, integer arithmetic and algebraic structures Classify and describe types of digital circuits
CO-2. Explain the principles and applications of set theory, logic, integer arithmetic and abstract algebra
CO-3. Apply set theory, logic, integer arithmetic and abstract algebra to solve a given problem
CO-4. Develop models of computing systems using logical and algebraic structures for given application
CO-5. Analyze the properties and behavior of algorithms, programs and computing systems using logical and algebraic constructs

Course Outcomes (COs)

Course Title & Code: Data Structures Foundation (CSD201A)

After the successful completion of this course, the student will be able to:

CO-1. Describe Linear and Non- Linear data structures such as Stacks, Queues, Linked Lists and Trees
CO-2. Explain the approaches used to implement the data structures
CO-3. Discuss the working of standard data access and manipulation algorithms
CO-4. Implement Stacks, Queues, Linked Lists and Trees
CO-5. Recommend a suitable data structure and algorithm for modeling a given scenario
CO-6. Develop computer programs using data structures to solve moderately complex problems

Course Outcomes (COs)

Course Title & Code: Logic Design (CSD202A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the elements of switching and digital design
CO-2. Explain the principles and techniques of sequential and combinational logic circuits
CO-3. Apply principles of sequential and combinational logic to design digital circuits
CO-4. Analyze and optimize digital logic circuits
CO-5. Design the digital components of a computer using digital logic circuits
CO-6. Test and validate digital logic circuits

M.S. Ramaiah University of Applied Sciences Bangalore - 560058

Dean
Faculty of Engineering and Technology
M.S. Ramaiah University of Applied Sciences
Bangalore-560058

Course Outcomes (COs)

Course Title & Code: Innovation and Entrepreneurship (BAU201A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the concepts and process of Innovation as well as entrepreneurship
- **CO-2.** Construct and apply the idea generation techniques
- **CO-3.** Discuss the opportunities for launching of new venture and various entry strategies
- **CO-4.** Examine innovative ideas for the creation and management of entrepreneurship
- **CO-5.** Formulate and present a viable business plan to the investors' appraisal

Course Outcomes (COs)

Course Title & Code: Python and Data Structures Laboratory (CSD204A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Identify fundamental data structures and algorithms to solve a given problem
- **CO-2.** Illustrate the working of different data structures
- **CO-3.** Develop algorithms and programs to solve a given problem using appropriate data structures
- **CO-4.** Design and develop solution for efficient sorting and searching operations
- **CO-5.** Evaluate the empirical performance of implemented data structures and algorithms
- **CO-6.** Document work done and prepare a laboratory report

Course Outcomes (COs)

Course Title & Code: Additional Mathematics - 1 (MTB202A)

After the successful completion of this course, the student will be able to:

- **CO-1.** State and explain the important theorems and solve simple mathematical problems in one variable calculus and vector algebra
- **CO-2.** State theorems and solve simple problems in two variable calculus
- **CO-3.** Solve complex real world problems associated with one and two real analysis
- **CO-4.** Illustrate fundamentals of MATLAB programming and write simple programs
- **CO-5.** Solve complex mathematical problems associated with linear algebra and compare the results with that of solutions obtained using MATLAB

Course Outcomes (COs)

Course Title & Code: Inferential Statistics (MCC203A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the principles of confidence interval and hypothesis testing
- **CO-2.** Describe the steps involved in computation of confidence interval and formulation of hypothesis for significance tests

CO-3. Solve simple mathematical problems associated with confidence interval and hypothesis testing

CO-4. Model real world problems using confidence interval and hypothesis testing

CO-5. Solve complex problems associated with confidence interval and hypothesis testing

Course Outcomes (COs)

Course Title & Code: Integral transforms (MCC204A)

After the successful completion of this course, the student will be able to:

CO-1. State and explain the important theorems in Fourier series and transforms

CO-2. Solve simple problems in Fourier series and transforms

CO-3. Apply Fourier series, transforms in solving complex real world engineering problems

CO-4. Implement the plot of piecewise, periodic and Fourier series of a function in MATLAB and illustrate transforms in MATLAB.

CO-5. Apply transforms in analyzing some real-world problems

Course Outcomes (COs)

Course Title & Code: Linear Algebra (MCC205A)

After the successful completion of this course, the student will be able to:

CO-1. Explain basic system of linear equations, vector spaces, eigenvalues, linear transformations, operators

CO-2. State and prove important theorems related to linear transformations, inner product space, eigenvalues and adjoints.

CO-3. Solve simple problems related to matrices, system of linear equations, orthogonal basis, eigenvalues and eigenvectors, matrix of linear transformations, orthonormal projections, singular value decomposition

CO-4. Model real world problems using linear algebra

CO-5. Solve complex problems related to diagonalization, linear transformations, change of basis, inner product spaces, eigenvalues and adjoints.

Course Outcomes (COs)

Course Title & Code: Design and Analysis of Algorithms (CSD206A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the concepts of design of algorithms

CO-2. Explain the principles of analysis of algorithms

CO-3. Choose appropriate techniques for design and analysis of algorithms for a given problem

CO-4. Analyze the worst case and average case complexity of a given algorithm

CO-5. Design efficient algorithms for a given problem

CO-6. Compare algorithms based on appropriately chosen measures of complexity

M.S. Ramaiah University of Applied Sciences * Bangalore - 560054 *

Dean
Faculty of Engineering and Technology
M.S. Ramaiah University of Applied Sciences
Bangalore-560058

Course Outcomes (COs)

Course Title & Code: Formal Languages and Automata Theory (CSL201A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe formal languages, automata and models of computation
- **CO-2.** Explain formal relationships among machines, languages and grammars
- **CO-3.** Analyze a given language for arriving at a suitable model of computation
- **CO-4.** Apply automata theory to prove or disprove languages
- **CO-5.** Design a grammar generating a given language and a computing machine that

Course Outcomes (COs)

Course Title & Code: Programming Paradigms (CSD208A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe and distinguish the concepts and features of various programming paradigms
- **CO-2.** Discuss the features of functional, object oriented and event driven programming paradigms
- **CO-3.** Apply concepts of functional, object oriented and event driven programming
- **CO-4.** Analyze the usefulness of a programming paradigms based on ease of expression and scale of development effort
- **CO-5.** Design software applications using functional, object oriented and event driven approaches
- **CO-6.** Synthesize software applications using functional, object oriented and event driven approaches

Course Outcomes (COs)

Course Title & Code: Environmental Studies (BTN101A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Illustrate the multidisciplinary nature of environmental studies and recognize the need for public awareness
- **CO-2.** Explain the various natural resources and their associated problems, ecosystem, and environmental pollution
- **CO-3.** Analyse the concept of ecosystem and classify various types
- **CO-4.** Compare biodiversity at local, national and global levels
- **CO-5.** Discuss various social issues pertaining to environment including sustainable development and energy issues

Course Outcomes (COs)

Course Title & Code: Mathematics and Computing Laboratory (MCL202A)

After the successful completion of this course, the student will be able to:

CO-1. Explain the concept of directional fields and numerical solution of first order ordinary differential equation

CO-2. Determine the solution for ordinary differential equations using MATLAB built-in commands

CO-3. Solve simple mathematical problems associated with first order ordinary differential equation using numerical methods and compare the results with that of solutions obtained by analytical methods

CO-4. Solve boundary value problems of ordinary differential equation using numerical methods

CO-5. Solve complex mathematical problems associated with ordinary differential equation using numerical methods and compare the results with that of solutions obtained using MATLAB

Course Outcomes (COs)

Course Title & Code: Programming Paradigms Laboratory (CSD208A)

After the successful completion of this course, the student will be able to:

CO-1. Relate the concepts of programming paradigm with the constructs of the programming language

CO-2. Express the model of an application as a program in functional and object-oriented programming languages

CO-3. Apply event handling and exception handling techniques in programs

CO-4. Analyze a given application and suggest programming approach and language based on easeof expression and scale of development

CO-5. Evaluate the usefulness of a programming approach and language for a given application requirement

CO-6. Document work done and prepared a laboratory report

Course Outcomes (COs)

Course Title & Code: Additional Mathematics - 2 (MTB212A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the fundamentals of ordinary differential equations State theorems and solve simple problems in two variable calculus

CO-2. Solve standard forms of ordinary differential equations Illustrate fundamentals of Linear algebra

CO-3. Model real world problems using ordinary differential equations and solve complex problems associated with ordinary differential equations

CO-4. Apply numerical methods to solve nonlinear equations in one variable, system of linear equations, interpolation and numerical quadrature, and implement the same using MATLAB

CO-5. Solve complex problems associated with nonlinear equations and linear systems, interpolation and numerical integration using MATLAB

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Faculty of Engineering and Technology
M.S. Ramaiah University of Applied Sciences
Bangalore-560058

M.S. Ramaiah University of Applied Sciences * Bangalore - 560054 *

Course Outcomes (COs)

Course Title & Code: Optimization Techniques (MCC301A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe fundamental of convex and concave functions, constrained and unconstrained optimization
- **CO-2.** State and explain important classical techniques and numerical methods of optimization
- **CO-3.** Demonstrate the skill to analyze a problem by choosing effective optimization tools
- **CO-4.** Analyze the proofs of theorems to draw meaningful conclusions
- **CO-5.** Apply the theory to solve problems with varying level of difficulty

Course Outcomes (COs)

Course Title & Code: Partial Differential Equations (MCC302A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the basic principles of partial differential equations.
- **CO-2.** Solve simple mathematical problems associated with first and second order partial differential equation.
- **CO-3.** Apply Fourier series to solve heat, wave and Laplace equations.
- **CO-4.** Apply partial differential equations to model physical phenomenon.
- **CO-5.** Solve complex problems associated with first and second order partial differential equations

Course Outcomes (COs)

Course Title & Code: Applications of Probability and Statistics in Finance (MCC303A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the concepts from Probability, Statistics and Stochastic Processes and their application in Finance
- **CO-2.** Explain the concepts and models of Financial Assets, Portfolios and Derivatives
- **CO-3.** Apply probabilistic models for the analysis of financial assets, portfolio management and derivatives
- **CO-4.** Evaluate the performance of financial assets, options and derivatives
- **CO-5.** Develop programming scripts for simple computational financial applications

Course Outcomes (COs)

Course Title & Code: Computer Networks (CSD301A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the protocols that operate in the TCP/IP stack and Wireless networks
- **CO-2.** Explain the typical applications of computer networks along with the protocols andsecurity considerations

CO-3. Choose appropriate network protocols for given applications
CO-4. Compare and analyze different wired and wireless network protocols for givenapplication requirements
CO-5. Design different types of servers using appropriate transport layer protocols based on application requirements
CO-6. Synthesize client-server based computer networks using the sockets API

Course Outcomes (COs)

Course Title & Code: Microprocessors and Architecture (CSD203A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the architecture of CPU, memory and I/O subsystems
CO-2. Explain the concepts and working of computer architectural subsystems
CO-3. Apply concepts of architecture to design simple architectural components
CO-4. Analyze, test and validate simple processor design
CO-5. Design the main functional units of architectural subsystems
CO-6. Select appropriate architectural features for a given application

Course Outcomes (COs)

Course Title & Code: Principles of Artificial Intelligence (AID201A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the concepts of artificial intelligence and intelligent agents
CO-2. Explain the principles of knowledge representation, search strategies, learning, reasoning and planning
CO-3. Apply the principles of knowledge representation, search strategies, learning, reasoning and planning to design intelligent agents
CO-4. Analyze a scenario and identify strategies for knowledge representation, search, learning, reasoning and planning
CO-5. Synthesize an intelligent agent for a given scenario
CO-6. Evaluate the performance of an intelligent agent based on appropriate measures of performance

Course Outcomes (COs)

Course Title & Code: Artificial Intelligence Laboratory (CSL304A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the process of modelling, design and synthesis of artificial intelligence applications
CO-2. Explain the principles of artificial intelligence and intelligent agents
CO-3. Apply the principles of knowledge representation, search strategies, learning, reasoning and planning to design intelligent agents
CO-4. Analyze a scenario and identify methods for knowledge representation, search, learning, reasoning and planning

CO-5. Synthesize an intelligent agent for a given scenario

CO-6. Evaluate the performance of an intelligent agent based on appropriate measures of performance

Course Outcomes (COs)

Course Title & Code: Computer Networks Laboratory (CSL301A)

After the successful completion of this course, the student will be able to:

CO-1. Relate the algorithms used by DLL and Network layers to their use in higher layer protocols

CO-2. Express client-server applications as a set of appropriate function calls, as well as algorithms and/or flowcharts

CO-3. Apply the Linux sockets API in the development of client-server-based computer networks

CO-4. Choose between different types of servers and appropriate transport layer protocols

CO-5. Design and implement applications using appropriate algorithms at PHY, DLL and Network Layers along with client-server interactions and create a laboratory report documenting the complete effort.

Course Outcomes (COs)

Course Title & Code: Microprocessors Laboratory (CSD205A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the elements of assembly language programming

CO-2. Discuss the various tools and techniques used for assembly language programming

CO-3. Apply assembly language constructs to optimize C programs

CO-4. Synthesize programs using inline assembly statements in C

CO-5. Analyze, test and validate developed assembly programs

CO-6. Document work done and prepare a laboratory report

Course Outcomes (COs)

Course Title & Code: Graph Theory and Optimization (CSC305A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the concepts, theories and techniques of graph theory and discrete optimization

CO-2. Explain the principles of graph theory, discrete optimization and their applications in Computer Science and Engineering

CO-3. Identify and apply appropriate approach from graph theory and discrete optimisation to formulate a given problem

CO-4. Design graph theory and discrete optimisation based algorithms to solve problems in Computer Science and Engineering

CO-5. Synthesize efficient algorithms for problems in Computer Science and Engineering using graph structures and discrete optimisation methods

CO-6. Evaluate the utility of discrete optimisation and graph structures for modelling and analysis of computing systems

Dean
Faculty of Engineering and Technology
M.S. Ramaiah University of Applied Sciences
Bangalore-560058

Course Outcomes (COs)

Course Title & Code: Information Security and Protection (CSC306A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe elements and components of information security and protection
- **CO-2.** Describe security attacks and defense mechanisms
- **CO-3.** Explain the requirements, principles and models of security policies
- **CO-4.** Analyze the security properties of a given model
- **CO-5.** Analyze a given scenario, application or system and recommend appropriate security policies and mechanisms
- **CO-6.** Develop security policies and mechanisms for a given scenario, application or system

Course Outcomes (COs)

Course Title & Code: Quantum Computing (MCC309A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the quantum mechanical, computational and information theoretical concepts underlying quantum computing
- **CO-2.** Describe the concepts of quantum computation, quantum circuits and quantum information theory
- **CO-3.** Explain the architectural and programming principles of quantum computing
- **CO-4.** Explain the principles of quantum algorithms and their applications
- **CO-5.** Analyse simple quantum computing circuits and algorithms
- **CO-6.** Design quantum algorithms for a given application

Course Outcomes (COs)

Course Title & Code: Machine Learning-I (AIC203A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the principles of Machine learning
- **CO-2.** Analyze the performance parameters of machine Learning
- **CO-3.** Apply naive Bayes' classifier or Nearest-Neighbor Classifiers to solve simple classification problems
- **CO-4.** Apply Linear Regression to solve the regression problems
- **CO-5.** Apply dimensionality reduction techniques.
- **CO-6.** Apply the k-means algorithm for Unsupervised Learning.

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Course Outcomes (COs)

Course Title & Code: Parallel Algorithms for Scientific Computing (MCC310A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss approaches to serial and parallel algorithm design
- **CO-2.** Explain parallelism present in scientific and engineering problems
- **CO-3.** Design algorithms for multi-core and shared memory multiprocessors
- **CO-4.** Use MPI and OpenCL
- **CO-5.** Apply parallel program design concepts to Scientific and Engineering problems

Course Outcomes (COs)

Course Title & Code: Seminar (CSS301A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Demonstrate the understanding of Selection of relevant Topics for Presentations
- **CO-2.** Get exposed to the Collection of Material, Reading and Comprehension
- **CO-3.** Learn to make a Report in a given format and Prepare Presentation on the Report
- **CO-4.** Get into Facing an Audience while presenting their Work and managing a Q&A Session

Course Outcomes (COs)

Course Title & Code: Numerical Analysis Laboratory (MCL201A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the concept of directional fields and numerical solution of first order ordinary differential equation
- **CO-2.** Determine the solution for ordinary differential equations using MATLAB built in commands
- **CO-3.** Solve simple mathematical problems associated with first order ordinary differential equation using numerical methods and compare the results with that of solutions obtained by analytical methods
- **CO-4.** Solve boundary value problems of ordinary differential equation using numerical methods
- **CO-5.** Solve complex mathematical problems associated with ordinary differential equation using numerical methods and compare the results with that of solutions obtained using MATLAB

Course Outcomes (COs)

Course Title & Code: Project Work-1 (CSP401A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Recognise the need for developing a new or improving an existing engineering product/system through an organised survey of literature and requirement analysis

CO-2. Define engineering design specifications based on the software requirements specification
CO-3. Design, model, synthesise, analyse the solution to meet the design specifications
CO-4. Evaluate the performance of the modelled system and justify its performance
CO-5. Demonstrate the system working in a virtual environment and make a presentation
CO-6. Write a project report

Course Outcomes (COs)

Course Title & Code: Internship (CSI401A)

After the successful completion of this course, the student will be able to:

CO-1. Understand the Process Stock of the Industry
CO-2. Gain experience of the Process Stock by working on an ongoing Project in the Industry
CO-3. Learn to manifest the work done in the form of a Report in a given format.
CO-4. Get experienced on Presenting the Work Done and Facing an Audience while presenting their Work.

Course Outcomes (COs)

Course Title & Code: Project Work-2 (CSP402A)

After the successful completion of this course, the student will be able to:

CO-1. Recognise the need for developing a new or improving an existing engineering product/system through an organised survey of literature and requirement analysis
CO-2. Define engineering design specifications based on the software requirements specification
CO-3. Design, model, synthesise, analyse the solution to meet the design specifications
CO-4. Evaluate the performance of the modelled system and justify its performance
CO-5. Demonstrate the system working in a virtual environment and make a presentation
CO-6. Write a project report

Course Outcomes (COs)

Course Title & Code: Information Theory and Coding (20MCE401A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the types of information sources, encoding techniques, channels and channel capacity
CO-2. Explain the basic concepts of information theory, Shannon's theorems, and various encoding techniques
CO-3. Solve simple problems to compute entropy, information measures and evaluate various codes
CO-4. Design encoders and decoders for error control coding techniques
CO-5. Solve complex problems to compute entropy, information measures and evaluate various codes
CO-6. Evaluate the performance of error detection and correction codes

Course Outcomes (COs)

Course Title & Code: Introduction to Real Analysis (20MCE404A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe fundamental properties of real numbers, sequences, series and functions
- **CO-2.** State and explain important theorems and ideas in real numbers, sequences, series and functions
- **CO-3.** Demonstrate the skill to construct rigorous mathematical proofs
- **CO-4.** Demonstrate the ability to communicate mathematical ideas and proofs
- **CO-5.** Analyze the proofs of theorems to draw meaningful conclusions
- **CO-6.** Apply the theory to solve problems with varying level of difficulty

Course Outcomes (COs)

Course Title & Code: Computer Vision (20CSE405A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss fundamentals of Digital Images with Image Formation and processing
- **CO-2.** To Discuss Image processing Techniques
- **CO-3.** Analyze and apply Image processing algorithms to solve recent computer vision problems.
- **CO-4.** Gather a basic understanding about the geo-metric relationships between 2D images world.
- **CO-5.** Apply classification, clustering algorithms for a given computer vision application
- **CO-6.** Implement machine learning algorithms for computer vision applications

Course Outcomes (COs)

Course Title & Code: Software Architecture (20CSE401A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the concept of software architecture and design patterns
- **CO-2.** Describe the principle behind software patterns and application of fundamental patterns
- **CO-3.** Summarize the need for software architecture and principles of classical architectural styles
- **CO-4.** Outline the major approaches to integrate patterns into software design
- **CO-5.** Apply software design patterns for various practical scenarios

Course Outcomes (COs)

Course Title & Code: Software Architecture (20MCE401A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Define and explain Legendre and Bessel differential equation, curvature, torsion, geodesics,

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manifolds and tensors

CO-2. State the results and theorems and solve simple problems in Legendre differential equations, Bessel differential equation, theory of curves and surfaces

CO-3. Apply differential geometry techniques to compute Gaussian curvature, mean curvature, principal curvature and torsion

CO-4. Solve complex engineering problems associated with Bessel differential equation, theory of curves and surfaces, orthogonal curvilinear coordinates and spherical curvilinear system

CO-5. Analyze real world problems associated with Bessel differential equation and curvature of space curves

Course Outcomes (COs)

Course Title & Code: Computational Number theory and Algebra (20MCE402A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the concepts of integer arithmetic, arithmetic of finite fields, arithmetic of polynomials over finite fields and primes.

CO-2. State and explain theorems/results on modular arithmetic, arithmetic of finite fields, and arithmetic of polynomials over finite fields and prime numbers.

CO-3. Explain algorithms for fast multiplication, fast factorization, GCD, primality testing.

CO-4. Apply the algorithms in solving problems which arise in modular arithmetic, polynomial over finite fields, primality testing and integer factorization

CO-5. Analyze time complexity of the algorithms discussed.

Course Outcomes (COs)

Course Title & Code: Topology (20MCE405A)

After the successful completion of this course, the student will be able to:

CO-1. Understand definitions and theorems related to topological spaces.

CO-2. Demonstrate ability and understanding of notions such as continuity, compactness, connectedness, countability, and separation axiom in topological spaces.

CO-3. Use continuous map and homeomorphism to understand structure of topological spaces

CO-4. Create new topological spaces using subspaces, product, and quotient topological spaces.

CO-5. Analyze the proofs of theorems to draw meaningful conclusions

CO-6. Apply the theory to solve problems with varying level of difficulty

Course Outcomes (COs)

Course Title & Code: Pattern Recognition (20AIE407A)

After the successful completion of this course, the student will be able to:

CO-1. Discuss concepts of pattern recognition and machine learning

CO-2. Discuss the concept of Bayesian inference and decision theory.

CO-3. Discuss the concepts of dimensionality reduction, principal component analysis and linear

discriminant analysis.

CO-4. Build classifiers for various pattern recognition applications.

CO-5. Apply pattern recognition and machine learning algorithms for image processing applications.

CO-6. Apply pattern recognition algorithms to solve problems and to mathematically model simple applications from engineering.

Course Outcomes (COs)

Course Title & Code: Principles and Practices of Software Testing (20CSE402A)

After the successful completion of this course, the student will be able to:

CO-1. Explain unit, integration and system test phases along with the nature of defects that the respective phases can detect

CO-2. Illustrate the process of designing tests for software program validation using functional testing techniques such as equivalence class partitioning, boundary value analysis and decision tables ensuring test adequacy

CO-3. Design tests for software program validation using structural and data-flow testing techniques satisfying coverage criteria

CO-4. Apply appropriate testing methods to validate Graphical User Interface based software

CO-5. Apply test methodologies including model-based testing for validation of object- oriented software at different levels

CO-6. Apply test-driven development methods to create software programs

Course Outcomes (COs)

Course Title & Code: Optimization Techniques (20MCC301A)

After the successful completion of this course, the student will be able to:

CO-1. Describe fundamentals of convex and concave functions, linear programming and constraint nonlinear optimization

CO-2. State and explain important classical techniques and numerical methods of constraint optimization

CO-3. Demonstrate the skill to analyze a problem by choosing effective optimization tools

CO-4. Apply optimization techniques to model real world problems

CO-5. Solve complex problems associated with linear programming and constraint optimization of function of several variables

Course Outcomes (COs)

Course Title & Code: Data Mining (20CSC304A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the conceptual framework of classification and clustering

CO-2. Explain the principles of supervised and unsupervised learning algorithms, training and test data

CO-3. Apply machine learning techniques to solve problems of practical importance
CO-4. Analyse the given data using classification and clustering algorithms
CO-5. Synthesise and solve data mining problems of practical importance using theoretical analysis and software tools

Course Outcomes (COs)

Course Title & Code: Number Theory and Elliptic Curve Cryptography (20MCE403A)

After the successful completion of this course, the student will be able to:

CO-1. Explain topics in elementary number theory
CO-2. Describe the mathematical background of concepts such as Finite Fields and Quadratic Residues
CO-3. Analyze cryptographic primitives with examples
CO-4. Solve numerical problems in number theory, cryptographic primitives and elliptic curves
CO-5. Apply cryptographic toolkit to solve problems in Elliptic Curve Cryptography

Course Outcomes (COs)

Course Title & Code: Computational Number theory and Algebra (20MCE402A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the concepts of integer arithmetic, arithmetic of finite fields, arithmetic of polynomials over finite fields and primes.
CO-2. State and explain theorems/results on modular arithmetic, arithmetic of finite fields, and arithmetic of polynomials over finite fields and prime numbers.
CO-3. Explain algorithms for fast multiplication, fast factorization, GCD, primality testing.
CO-4. Apply the algorithms in solving problems which arise in modular arithmetic, polynomial over finite fields, primality testing and integer factorization
CO-5. Analyze time complexity of the algorithms discussed.

Course Outcomes (COs)

Course Title & Code: Artificial Intelligence and Healthcare (20AIE404A)

After the successful completion of this course, the student will be able to:

CO-1. To describe the role and assess the benefits and risks of Artificial Intelligence in Healthcare
CO-2. To describe data mining in clinical data analysis
CO-3. To discuss the role of deep learning and machihe learning for diverse types of healthcare data
CO-4. To discuss and apply pattern recognition in medical image analysis for disease diagnosis
CO-5. To apply Natural Language Processing methods to extract information from Electronic Health Records

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Course Outcomes (COs)

Course Title & Code: Service Oriented Architecture (20ISE407A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Intended Learning Outcome
- **CO-2.** Explain software oriented architectures
- **CO-3.** Design medium scale software project development using SOA principles
- **CO-4.** Develop SOA messages from business use cases
- **CO-5.** Design and implementation of modern SOA and SOA-specific methodologies, technologies and standards
- **CO-6.** Create composite services by applying composition style

Course Outcomes (COs)

Course Title & Code: Advanced Numerical Methods (20MCE403A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Illustrate various methods of numerical computation of Eigen values
- **CO-2.** Illustrate various methods to solve partial differential equations
- **CO-3.** Apply numerical methods to solve partial differential equations using MATLAB
- **CO-4.** Analyze real world problems associated with computing eigenvalues and partial differential equations
- **CO-5.** Solve complex problems arising in real world using finite volume and finite elements methods to solve partial differential equations

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