# R.M.D. ENGINEERING COLLEGE

**(An Autonomous Institution)**

**REGULATIONS 2024**

**B.Tech. COMPUTER SCIENCE AND BUSINESS SYSTEMS**

**CHOICE BASED CREDIT SYSTEM**

**CURRICULUM**

**(For the students admitted from the academic year 2025-26 onwards)**

| **SEMESTER – II** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Title** | **Category** | **Contact Periods** | **L** | **T** | **P** | **C** |
| **THEORY COURSE** | | | | | | | | |
| 1 | 24MA203 | Linear Algebra | BSC | 4 | 3 | 1 | 0 | 4 |
| 2 | 24GE201 | Tamils and Technology | HSMC | 1 | 1 | 0 | 0 | 1 |
| **THEORY COURSES WITH LABORATORY COMPONENT** | | | | | | | | |
| 3 | 24CS201 | Data Structures | ESC | 6 | 3 | 0 | 3 | 4.5 |
| 4 | 24CS202 | Java Programming | ESC | 6 | 3 | 0 | 3 | 4.5 |
| 5 | 24AM201 | Introduction to Artificial Intelligence | ESC | 4 | 2 | 0 | 2 | 3 |
| 6 | 24EC201 | Principles of Electronics Engineering (Lab Integrated) | ESC | 5 | 3 | 0 | 2 | 4 |
| **LABORATORY COURSE** | | | | | | | | |
| 7 | 24GE211R | Idea Lab II | EEC | 4 | 0 | 0 | 4 | 2 |
| **EMPLOYABILITY ENHANCEMENT COURSES** | | | | | | | | |
| 8 | 24HS211 | Innovation and Creativity Skills Development | EEC | 1 | 1 | 0 | 0 | 1 |
| **AUDIT COURSE** | | | | | | | | |
| 9 | 24AC201 | Yoga for Stress Management | AC | 1 | 0 | 0 | 1 | 0 |
| 10 | 24AC202 | Physical Education – II (Non Credit) | AC | 1 | 0 | 0 | 1 | 0 |
| 11 | 24AC203 | Foreign Language (Japanese/German/Others) | AC | Basic (Level 1) Certification | | | | |
| | | | **TOTAL** | **33** | **16** | **1** | **16** | **24** |

| Course Code | LINEAR ALGEBRA | L | T | P | C |
|---|---|---|---|---|---|
| 24MA203 | | 3 | 1 | 0 | 4 |

**OBJECTIVES:**

**The course will enable the learners to:**

- ensure the fundamental concepts of matrix operations.
- impart the knowledge of vectors and linear combinations.
- illustrate the basic notions associated with vector spaces and its properties.
- utilize the Gram-Schmidt ortho normalization process.
- implement the concept of linear combinations in image processing and Machine learning.

**UNIT I MATRICES AND DETERMINANTS 12**

Introduction to Matrices and Determinants – Solution of Linear Equations – Cramer's rule – Inverse of a Matrix.

**UNIT II VECTORS AND LINEAR COMBINATIONS 12**

Vectors and linear combinations – Rank of a matrix – Gaussian elimination – LU Decomposition – Solving Systems of Linear Equations using LU Decomposition method.

**UNIT III VECTOR SPACE 12**

Vector space – Dimension – Basis – Orthogonality – Projections – Gram-Schmidt orthogonalization and QR decomposition.

**UNIT IV LINEAR TRANSFORMATIONS 12**

Linear transformations – Eigen values and Eigen vectors – Positive definite matrices – Hermitianand unitary matrices.

**UNIT V APPLICATIONS OF MATRICES 12**

Singular value decomposition and Principal component analysis – Introduction to their applications in Image Processing and Machine Learning.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

**Upon completion of the course, the students will be able to:**

CO1: apply Cramer's rule for solving the system of linear equations.

CO2: utilize the LU Decomposition technique to solve the system of equations.

CO3: execute the QR decomposition for a given matrix.

CO4: develop problem-solving abilities through the application of linear algebra techniques.

CO5: determine the eigenvalues and eigenvectors.

CO6: apply matrix techniques in Image Processing and Machine Learning.

**TEXT BOOKS:**


1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi 2021.
2. H. Friedberg, A. J. Insel and L. Spence, "Linear Algebra", Prentice Hall of India,4th Edition, New Delhi, 2004.


**REFERENCES:**


1. Peter V. O'Neil, "Advanced Engineering Mathematics", Cengage Learning, 7th Edition.
2. Michael. D. Greenberg, "Advanced Engineering Mathematics", Pearson, 2nd Edition.
3. Gilbert Strang, "Introduction to linear algebra", Wellesley - Cambridge Press, 5th Edition.
4. P. N. Wartikar & J.N. Wartikar, "Applied Mathematics", Volume I & II, Pune Vidyarthi Griha Prakashan, 7th Edition, 1994.
5. R.C. Gonzalez and R.E. Woods, "Digital Image Processing", Pearson Education International, 3rd Edition.
6. Steven J. Leon, Linear Algebra with Applications, Pearson Education International, 9th Edition.
7. NPTEL course on "Linear Algebra", by Prof. K. C. Sivakumar, IIT Madras: https://archive.nptel.ac.in/courses/111/106/111106051/#

| Course Code | TAMILS AND TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| 24GE201 | | 1 | 0 | 0 | 1 |

**OBJECTIVES:**

**The course will enable the learners to:**

- recognize the historical significance of weaving and pottery technologies in ancient Tamil civilization.
- highlight the concepts of design and construction technology during the Sangam age.
- provide an overview of manufacturing technology and its role in Tamil society.
- illustrate the agricultural and irrigation techniques employed in ancient Tamil society.
- promote scientific Tamil and Tamil computing.

**UNIT I WEAVING AND CERAMIC TECHNOLOGY 3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

**UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

**UNIT III MANUFACTURING TECHNOLOGY 3**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and gold-Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

**UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3**

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

**UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

**TOTAL: 15 PERIODS**

**COURSE OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1**: identify the role of weaving and ceramic technology in ancient Tamil Culture.

**CO2**: assess the design and construction technology ideas in the current Tamil society.

**CO3**: identify the different types of manufacturing technology used in Tamil society and their significance.

**CO4**: classify agricultural and irrigation technologies in ancient Tamil society and its current relevance.

**CO5**: discuss the fundamentals of scientific Tamil and Tamil computing.

**REFERENCE BOOKS**


1. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL –(in print)
5. Social Life of the Tamils - The Classical Period (Dr.S .Singaravelu) (Published by:International Institute of Tamil Studies.
6. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu ) (Published by: International Institute of Tamil Studies).
7. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by:International Institute of Tamil Studies.)
8. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by:
9. Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay)(Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil NaduText Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL).

| Course Code | DATA STRUCTURES | L | T | P | C |
|---|---|---|---|---|---|
| 24CS201 | (Theory Course with Laboratory Component) | 3 | 0 | 3 | 4.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- understand the concepts of List ADT.
- learn linear data structures – stacks and queues ADTs.
- understand and apply Tree data structures.
- understand and apply Graph structures.
- analyze sorting, searching and hashing algorithms.

**UNIT I LINEAR DATA STRUCTURES – LIST 9+9**

Algorithm analysis - running time calculations - Abstract Data Types (ADTs) – List ADT-array- based implementation – linked list implementation – singly linked lists -circularly linked lists - doubly-linked lists – applications of lists – Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

**List of Exercise/Experiments:**

- Array implementation of List ADTs.
- Linked list implementation of List ADTs.

**UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES 9+9**

Stack ADT – Stack Model - Implementations: Array and Linked list - Applications - Balancing symbols - Evaluating arithmetic expressions - Conversion of Infix to postfix expression - Queue ADT – Queue Model - Implementations: Array and Linked list - applications of queues - Priority Queues – Binary Heap – Applications of Priority Queues.

**List of Exercise/Experiments:**

- Array implementation of Stack and Queue ADTs.
- Linked list implementation of Stack and Queue ADTs.
- Applications of List – Polynomial manipulations
  Applications of Stack – Infix to postfix conversion and expression evaluation.

**UNIT III NON LINEAR DATA STRUCTURES – TREES 9+9**

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications oftrees – binary search tree ADT– AVL Tree.

**List of Exercise/Experiments:**

- Implementation of Binary Trees and operations of Binary Trees.
- Implementation of Binary Search Trees.
  Implementation of Heaps using Priority Queues.

**UNIT IV NON LINEAR DATA STRUCTURES – GRAPHS 9+9**

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Applications of graphs – BiConnectivity – Euler circuits.

**List of Exercise/Experiments:**

- Graph representation and Traversal algorithms.

## UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9+9

Searching- Linear Search - Binary Search - Sorting - Bubble sort - Selection sort - Insertion sort – Hashing - Hash Functions – Separate Chaining – Open Addressing –Rehashing – Extendible Hashing.

**List of Exercise/Experiments:**

- Implement searching and sorting algorithms.

**TOTAL: 45+45=90 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Analyze algorithms and abstract data types (ADTs).

**CO2:** Evaluate fundamental data structures.

**CO3:** Implement linked data structures and its application.

**CO4:** Apply advanced tree data structures.

**CO5:** Understand basic graph theory concepts.

**CO6:** Evaluate various searching and sorting algorithms.

**TEXTBOOKS:**


1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, 4th Edition,Pearson Education, 2014.
2. Sartaj Sahni, “Data Structures, Algorithms and Applications in C++”, Silicon paperpublications, 2004.


**REFERENCES:**


1. Rajesh K. Shukla, “Data Structures using C and C++”, Wiley India Publications,2009.
2. Narasimha Karumanchi, “Data Structure and Algorithmic Thinking with Python:Data Structure and Algorithmic Puzzles”, CareerMonk Publications, 2020.
3. Jean-Paul Tremblay and Paul Sorenson, “An Introduction to Data Structures with Application”, McGraw-Hill, 2017.
4. Mark Allen Weiss, “Data Structures and Algorithm Analysis in Java”, Third Edition,Pearson Education, 2012.
5. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of DataStructures in C”, Second Edition, University Press, 2008.
6. Ellis Horowitz, Sartaj Sahni, Dinesh P Mehta, “Fundamentals of Data Structures inC++”, Second Edition, Silicon Press, 2007.
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013501578165051392105 84/ overview


**LIST OF EQUIPMENTS:**

1. Systems with Linux/Ubuntu Operating System with gnu C++ compiler

| Course Code | JAVA PROGRAMMING (Theory Course with Laboratory Component) | L | T | P | C |
|---|---|---|---|---|---|
| 24CS202 | | 3 | 0 | 3 | 4.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- explain object oriented programming concepts and fundamentals of Java
- apply the principles of packages, interfaces and exceptions
- develop a Java application with I/O streams, threads and generic programming
- build applications using strings and collections.
- apply the JDBC concepts

**UNIT I JAVA FUNDAMENTALS 9+9**

An Overview of Java - Data Types, Variables, and Arrays – Operators - Control Statements – Class Fundamentals – Declaring objects – Methods – Constructors – thiskeyword – Overloading methods - Overloading constructors - Access Control – Static –Final

**List of Exercise/Experiments:**

1. Develop a Java application to generate Electricity bill. You must use one super classcalled EB Bill and must have two sub classes namely Domestic Bill and Commercial Bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff
   If the type of the EB connection is domestic, calculate the amount to be paid asfollows: First 100 units - Rs. 1 per unit
   101-200 units - Rs. 2.50 per unit 201 -500 units - Rs. 4 per unit ,> 501 units - Rs. 6 per unit
   If the type of the EB connection is commercial, calculate the amount to be paid asfollows: First 100 units - Rs. 2 per unit ,101-200 units - Rs. 4.50 per unit 201 -500 units - Rs. 6 per unit, 501 units - Rs. 7 per unit
2. Arrays Manipulations: (Use Methods for implementing these in a Class)
   - Find kth smallest element in an unsorted array
   - Find the sub array with given sum
   - Matrix manipulations – Addition, Subtraction, Multiplication
   - Remove duplicate elements in an Array
   - Accept an integer value N and print the Nth digit in the integer sequence 1, 2, 3,4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and so on till infinity.

   Example: The 11th digit in the sequence 12345678910111213…. is 0.

**UNIT II INHERITANCE, INTERFACES AND EXCEPTION HANDLING 9+9**

Inheritance: Inheritance basics, Using super, Method Overriding, Using Abstract Classes, Using final with Inheritance - Package and Interfaces: Packages, Packages and member access, Importing Packages, Interfaces, Static Methods in an Interface – Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions.

**List of Exercise/Experiments:**

1. Develop a Java application to implement currency converter (Dollar to INR, EUROto INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM andvice versa), time converter (hours to minutes, seconds and vice versa) using packages.
2. Develop a Java application with Employee class with Emp_name, Emp_id, Address,Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% ofBP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
3. Design a Java interface for ADT Stack. Implement this interface using array andbuilt-in classes. Provide necessary exception handling in both the implementations.
4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains the methods print Area () that prints the areaof the given shape and Numberofsides() that prints the number of sides of the given shape.
5. Write a Java program to apply built-in and user defined exceptions.

## UNIT III MULTITHREADING, I/O AND GENERIC PROGRAMMING 9+9

Multithreaded Programming: Creating a Thread, Thread Priorities, Synchronization, Interthread Communication – I/O: I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing Files – Generics: Introduction, Generic class, Bounded Types, Generic Methods, Generic Interfaces, Generic Restrictions.

**List of Exercise/Experiments:**

1.Write a Java program to read and copy the content of one file to other by handling all file related exceptions.

## UNIT IV STRING HANDLING AND COLLECTIONS 9+9

Lambda Expressions - String Handling – Collections: The Collection Interfaces, The Collection Classes – Iterator – Map - Regular Expression Processing.

**List of Exercise/Experiments:**

1. String Manipulation:
   a. Reversing a set of words and count the frequency of each letter in the string.
   b. Pattern Recognition - Find the number of patterns of form 1[0]1 where [0] represents any number of zeroes (minimum requirement is one 0) there should notbe any other character except 0 in the [0] sequence in a given binary string.
   c. Remove all the occurrences of string S2 in string S1 and print the remaining.
   d. Find the longest repeating sequence in a string
   e. Print the number of unique string values that can be formed by rearranging the letters in the string S.

2. Write a Java program that correctly implements producer consumer problem usingthe concept of inter thread communication.
3. Collections:
   a. Write a program to perform string operations using Array List. Write functions for the following
      i. Append - add at end
      ii. Insert – add at particular index
      iii. Search
      iv. List all string starts with given letter

   b. Find the frequency of words in a given text.

**UNIT V JDBC CONNECTIVITY 9+9**

/ JDBC – DataSource, Configurations, Connection, Connection Pools, Driver Types, ResultSet, Prepared Statement, Named Parameter, Embedded SQL (Insert, Update,Delete, Join, union etc), ResultSet Navigation, Connection Close and Clean up.

**List of Exercise Experiments:**

Mini Project (using JDBC)

**TOTAL: 45+45=90 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Solve core Java programming concepts.

**CO2:** Utilize object-oriented programming (OOP) principles.

**CO3:** Demonstrate competency in handling exceptions and implementing multithreading.

**CO4:** Develop expertise in input/output (I/O) operations and file handling.

**CO5:** Apply advanced Java programming concepts with generics and lambda expressions.

**CO6:** Implement database connectivity using JDBC.

**TEXTBOOKS:**

1. Herbert Schildt, “Java: The Complete Reference”, 11th Edition, McGraw Hill Education, 2019.

**REFERENCES:**

1. Cay S. Horstmann, Gary Cornell, “Core Java Volume – I Fundamentals”, 11thEdition, Prentice Hall, 2019.
2. Paul Deitel, Harvey Deitel, Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
3. Steven Holzner, Java 2 Black book, Dream tech press, 2011.
4. Timothy Budd, Understanding Object-oriented programming with Java, ThirdEdition, Pearson Education, 2008.
5. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_29959473947367270000_shared/overview

**LIST OF EQUIPMENTS:**

1. Java and Eclipse / NetBeans IDE or Equivalent

| Course Code | INTRODUCTION TO ARTIFICIAL INTELLIGENCE (Theory Course with Laboratory Component) | L | T | P | C |
|---|---|---|---|---|---|
| 24AM201 | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Understand the basics and applications of Artificial Intelligence.
- Apply the basics of Python programming.
- Use python libraries to solve simple problems.
- Understand the different types of Machine Learning algorithms.
- Solve real world problems using AI/ML.
- Explore the various applications in the field of Artificial Intelligence and Machine Learning.

**UNIT I ARTIFICIAL INTELLIGENCE 6+6**

Introduction – Types of AI – ANI, AGI, ASI – Narrow, General, Super AI, Examples - AI problems – Production Systems – State space Representation – Applications of AI in various industries.

**List of Exercise:**

1. Build a simple AI model using python.

**UNIT II BASICS OF PYTHON 6+6**

Introduction to Python programming – Arithmetic Operators - values and types - variables, expressions, statements – Functions – Conditionals and Recursion –Iteration.

Lists: Sequence, Mutable, Traversing, Operations, list slices, list methods - Tuples: Immutable, Tuple Assignment, Tuple as Return Values, Comparing and Sorting.

**List of Exercises:**

1. Compute the GCD of two numbers.
2. Operations on Tuples: a) finding repeated elements, b) slice a tuple c) reverse a tuple d) replace last value of a tuple.

**UNIT III PYTHON LIBRARIES 6+6**

Introduction to Numpy - Multidimensional Ndarrays – Indexing – Properties – Constants – Data Visualization: Ndarray Creation – Matplotlib - Introduction to Pandas – Series – Dataframes – Visualizing the Data in Dataframes - Pandas Objects – Data Indexing and Selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – Joins- Pivot Tables - String operations – Working with time series – High performance Pandas.

**List of Exercises:**

1. Download, install and explore the features of R/Python for data analytics
   - Installing Anaconda
   - Basic Operations in Jupyter Notebook
   - Basic Data Handling
2. Working with Numpy arrays - Creation of numpy array using the tuple, Determine the size, shape and dimension of the array, Manipulation with array Attributes, Creation of Sub array, Perform the reshaping of the array along the row vector and column vector, Create two arrays and perform the concatenation among the arrays.
3. Working with Pandas data frames - Series, DataFrame , and Index, Implement the Data Selection Operations, Data indexing operations like: loc, iloc, and ix, operations of handling the missing data like

None, Nan, Manipulate on the operation of Null Vaues (is null(), not null(), dropna(), fillna()).

4. Perform the Statistics operation for the data (the sum, product, median, minimum and maximum, quantiles, arg min, arg max etc.).

5. Use any data set compute the mean ,standard deviation, Percentile.

**UNIT IV MACHINE LEARNING** **6+6**

Introduction – ML Algorithms Overview – Types – Supervised – Unsupervised – Reinforcement Learning – Introduction to Neural Networks – Working of Deep Learning – Applications of DL – Ethical consideration in AI and ML.

**List of Exercise:**

1. Apply any Machine Learning model to predict the sales in a store.

**UNIT V CASE STUDIES** **6+6**

Disease Prediction – Share Price Forecasting – Weather Prediction – Domain Specific Case Studies.

List of Domain Specific Case Studies:

- For CSE & allied: Sentiment analysis of product reviews using machine learning.
- For ECE & allied: Smart homes using AI.
- For EEE: Forecasting of Renewable energy availability during a specified period using AI.
- Civil: Application of ML for crack detection on concrete structures.
- Mech: Predictive Maintenance for CNC Machines Using AI and Machine Learning.

**List of Exercise:**

1. Build a machine learning model to solve any real-world problem from your domain.

**TOTAL: 30(L) + 30(P) = 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Elaborate the basics and applications of Artificial Intelligence**.**

**CO2:** Apply the basics of Python programming to solve problems.

**CO3:** Use python libraries to solve simple ML problems.

**CO4:** Outline the different types of Machine Learning algorithms.

**CO5:** Use Machine Learning Algorithms to solve real world problems.

**CO6:** Outline the recent developments in the field of Artificial Intelligence.

**TEXT BOOKS:**


1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2. Jake VanderPlas, "Python Data Science Handbook – Essential tools for working with data", O'Reilly, 2017.
3. Steve Abrams, "Artificial Intelligence and Machine Learning for Beginners: A simple guide to understanding and Applying AI and ML", Independently published, May 14, 2024.

**REFERENCES:**


1. Vinod Chandra S S, Anand Hareendran S, Artificial Intelligence and Machine Learning, PHI Learning, 2014.
2. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice Hall, 2010.
3. Ethem Alpaydın, Introduction to Machine Learning, Second Edition, the MIT Press, Cambridge, Massachusetts, London, England.
4. Stephen Marsland, Machine Learning - An Algorithmic Perspective, 2nd Edition, 2015, by Taylor & Francis Group, 2015.
5. Tom M. Mitchell, Machine Learning, McGraw-Hill Science, ISBN: 0070428077
6. Mayuri Mehta, Vasile Palade, Indranath Chatterjee, Explainable AI: Foundations, Methodologies and Applications, Springer, 2023.
7. Siddhartha Bhattacharyya, Indrajit Pan, Ashish Mani, Sourav De, Elizabeth Behrman, Susanta Chakraborti, "Quantum Machine Learning", De Gruyter Frontiers in Computational Intelligence, 2020.


**LIST OF EQUIPMENTS:**

1. Systems with Anaconda, Jupyter Notebook, Python.

| Course Code | PRINCIPLES OF ELECTRONICS ENGINEERING (Theory Course with Laboratory Component) | L | T | P | C |
|---|---|---|---|---|---|
| 24EC201 | | 3 | 0 | 2 | 4 |

**COURSE OBJECTIVES:**

The Course will enable learners to:

- Study the operation of semiconductor diodes and their characteristics
- Acquire knowledge about the operation and characteristics of BJT under various configurations
- Introduce the structure and terminal characteristics of FET and MOSFET
- Understand the concepts of feedback and operational amplifiers with its 'applications
- Gain knowledge about digital logic circuits.

**UNIT I SEMI CONDUCTOR DIODES AND CIRCUITS 9**

Semiconductors: Introduction to Semiconductors: intrinsic & extrinsic, P&N-type semiconductors. Diodes and Diode Circuits: Formation of P-N junction, built-in potential, forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener break down and its reverse characteristics. Rectifier circuits: half wave, full wave.

**UNIT II BIPOLAR JUNCTION TRANSISTORS 9**

Formation of PNP / NPN junctions and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, transistor action, currentamplification factors for CB and CE modes.

**UNIT III FIELD EFFECT TRANSISTORS 9**

Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletionand enhancement type.

**UNIT IV FEEDBACK AMPLIFER AND OPERATIONAL AMPLIFIERS 9**

Concept (Block diagram), positive and negative feedback, loop gain, open loop gain, feedback factors, condition of oscillation, Barkhausen criteria. Introduction to integrated circuits: operational amplifier and its terminal properties; Application of operational amplifier;inverting and non-inverting mode of operation.

**UNIT V DIGITAL ELECTRONICS FUNDAMENTALS 9**

Difference between analog and digital signals, Logic ICs, half and full adder / subtract or,multiplexers, demultiplexers.

**THEORY;45 PERIODS**

**LIST OF EXPERIMENTS:**

1. Semiconductor Diodes and application,
   a. Characteristics of PN junction diode
   b. Zener diode characteristics
2. Transistor circuits
   a. Common Emitter Input Output characteristics
3. JFET, oscillators and amplifiers.
   a.FET characteristics
4. Op amp based experiments (Analysis using Simulation Spice)
   a.Op amp as inverting amplifier, non-inverting amplifier
5. Digital experiments
   a. Simplification, realization of Boolean expressions using logic gates / Universalgates.
   b. Realization of Half/Full adders and Half/Full Subtractors using logic gates.
   c. Construction of Multiplexer and Demultiplexer circuits using logic gates.

**LAB : 30 PERIODS**
**TOTAL: 75 PERIODS**

**COURSE OUTCOMES**

Upon completion of the course, the students will be able to:

CO1: Examine the performance of electronic circuits using PN junction diode andZenerdiode.

CO2: Construct electronic circuits using BJT and to sketch the input and outputcharacteristics.

CO3: Examine the terminal characteristics of FET and MOSFET

CO4: Acquire the knowledge on feedback amplifiers and operational amplifiers.

CO5: Design of simple Digital Logic Circuits.

CO6: Perform practical exercises as an individual and / or team member to manage the task in time.

**TEXTBOOKS:**


1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar , Microelectronic Circuits:Theory and Applications, 7th Edition, Oxford University Press ,2017.
2. Jacob Millman, Christos Halkias, Chetan Parikh, Millman's Integrated Electronics,2nd Edition, McGraw Hill Education,2017
3. M.Morris Mano, Digital Logic & Computer Design, 1st Edition, Pearson,2016


**REFERENCES:**


1. RobertL. Boylestad, Louis Nashelsky Electronic Devices and Circuit Theory, 11thEdition, Pearson,2017.
2. Ben Streetman, Sanjay Banerjee, Solid State Electronic Devices,6th Edition,Pearson,2015.
3. Albert Paul Malvino, Electronic Principle,8th Edition, McGraw Hill, 2015.
4. D Schilling C Belove T Apelewicz R Saccardi Electronics Circuits: Discrete &Integrated, 3rd Edition, McGraw Hill, 2002.
5. Jacob Millman, Arvin Grabel, Micro electronics,2nd Edition, McGraw Hill, 2017.
6. S. Salivahanan, N. Suresh Kumar, A. Vallavaraj, Electronics Devices & Circuits, 4thEdition, McGraw Hill, 2017.


**NPTEL LINK**

https://nptel.ac.in/courses/108105132

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS**

2. BC 107, BC 148, 2N2646, BFW10 - 25 each
3. 1N4007, Zener diodes - 25 each
4. Bread Boards -15 Nos
5. CRO (30MHz) - 10 Nos
6. Signal Generator /Function Generators (3 MHz) - 15 Nos
7. Transistor/FET (BJT-NPN-PNP and NMOS/PMOS) - 50 Nos
8. Dual power supply/ single mode power supply - 15 Nos
9. IC Trainer Kit -15 Nos
10. Seven segment display -15 Nos
11. Digital LCR Meter - 2 Nos
12. Multimeter -15 Nos
13. IC tester -2Nos

14. Standalone desktop PCs - 15 Nos.
15. SPICE Circuit Simulation Software: (any public domain or commercial software)
16. ICs each 50 Nos
17. 7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 / 74151 / 74147 / 7445 / 7476/7491/
18. 555 / 7494 / 7447 / 74180 / 7485 / 7473 74138 / 7411 / 7474/Op-Amps

| Course Code | IDEA LAB II (Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| 24GE211R | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

**The Course will enable the learners to:**

- familiarize with the basic features and functionalities of office software packages for documentation, data processing, and presentation.
- develop a foundational understanding of smart electronic systems by designing and implementing basic sensor-based applications using Arduino.
- design, fabricate and test printed circuit boards (PCBs) for simple electronic circuits using PCB design software and milling machines.
- **enrich their knowledge in contemporary systems and technologies** such as laser cutting machine and CNC router, highlighting their role in modern society and industry.
- perform a smart land audit by leveraging geospatial tools, specifically Google Earth, for mapping, analyzing, and interpreting land usage, boundaries, terrain features, and other geospatial attributes.

**LIST OF EXERCISES**

**(A). Introduction to office Application**

1. Introduction to office package. **(CSBS)**

**(B) ) Smart Electronic Systems using Sensors and Arduino**

1. Development of a Door Bell Circuit using Arduino. **(EEE)**
2. Build a simple Arduino-Based Water Level Indicator for a Tank/Container **(EEE)**
3. Build a simple Interfacing circuit of LM35 Temperature Sensor with Arduino **(EEE)**
4. Design and build Ultrasonic Distance Measurement System and LED Indication using Arduino and Ultrasonic Sensor**(EEE)**
5. Design and build a simple home automation demo (e.g., LED turns on when room is dark using LDR + Arduino). **(ECE)**

**(C ) Hands-on Practice in PCB Design**

1. Design, mill, populate, and validate a single-sided printed circuit board (PCB) for a simple low-power electronic circuit using a PCB milling machine**. (ECE)**

**(D) Contemporary Systems**

**1.** Laser cutting of 2D profiles for press-fit cube assembly**. (MECH)**

2. CNC Router machining of MDF for press-Fit design**. (MECH)**

**(E ) Testing of Material Properties**

1. Geospatial Smart Land Audit Using Google Earth. **(CE)**

**TOTAL: 60 PERIODS**

**OUTCOMES**

**After successful completion of the course the students will be able to**

**CO1** Analyze data using a spreadsheet application.

**CO2** Design and construct simple but practical electronic systems such as doorbells, water level indicators, and proximity detectors.

**CO3** Evaluate the effectiveness of PCB-based implementation compared to breadboard or wired circuits.

**CO4** Evaluate the role of contemporary systems in addressing societal and industrial needs.

**CO5** Comprehend basic concepts of GIS (Geographic Information Systems), remote sensing, and digital land analysis.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

| S.No | Equipment Name | Quantity | DEPT |
|---|---|---|---|
| 1 | Desktop | 30 Nos | CSBS |
| 2 | MS Office/LibreOffice/Google Docs | 30 Nos | CSBS |
| 3 | Buzzer | 10 Nos | EEE |
| 4 | 9 V Battery | 5 Nos | EEE |
| 5 | LDR | 15 Nos | EEE |
| 6 | Water Level Sensor Strip | 5 Nos | EEE |
| 7 | LM35 Temperature Sensor | 5 nos | EEE |
| 8 | Ultrasonic Sensor | 5 nos | EEE |
| 9 | Bread Board | 5 Nos | ECE |
| 10 | Container with lit indication | 1 No | EEE |
| 11 | PCB Milling machine | 1 No | ECE |
| 12 | Arduino UNO/NANO Board | 10 Nos | EEE |
| 13 | LED | 10 Nos | EEE |
| 14 | Resistors (Different Ranges) | 10 Nos | ECE |
| 15 | CNC Router | 1 No | MECH |
| 16 | Laser cutting Machine | 1 No | MECH |
| 17 | | 1 No | MECH |
| 18 | Google Earth | Open Source Software | CE |

| Course Code | INNOVATION AND CREATIVITY SKILLS DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| 24HS211 | | 1 | 0 | 0 | 1 |

**OBJECTIVES:**

**The course will enable the learners to:**

- Understand study plans, co-curricular activities, programming skills, recruitment test patterns, and hiring strategies through national qualifiers and hackathons.
- Equip students with strategies for higher education, resume enhancement, project management, and securing internships
- Understand entrepreneurship fundamentals, including key differences, global hubs, business ideas, and scalability.
- Develop essential entrepreneurial skills such as opportunity recognition, patience, risk management, communication, persistence, and leadership
- Understand life, success, self-confidence, health, scientific heritage, personal counseling, and cybercrime awareness

**UNIT I STEPPING STONE – ENGINEERING CAREERS AND SKILL DEVELOPMENT 3**

Study Plans and Resources - Identification of key resources and job opportunities - career prospects and academic growth through co-curricular activities - importance of programming/coding skills - Overview of test patterns and essential skills for popular campus recruiters - Comparison of IT Services, Dream, and Super Dream offers and their recruitment processes - National Qualifier Tests and their impact on hiring processes – Overview of Corporate contests and hackathons (e.g., TCS Codevita, HackerRank)

**UNIT II STEPPING STONE – HIGHER EDUCATION AND CAREER DEVELOPMENT 3**

Overview of higher education opportunities: GATE, GRE, GMAT, XAT, CAT, MAT - Exam formats, preparation strategies, and timelines - Resume Enhancement Strategies - Project Management - Steps to develop projects from proposal to prototype - Internship Pathways - Strategies for maximizing internship experiences for career advancement

**UNIT III FUNDAMENTALS OF ENTREPRENEURSHIP: FROM IDEAS TO VENTURES 3**

Introduction to Entrepreneurship – Intrapreneur vs. entrepreneur - Roles and Contributions - Global Entrepreneurship Hubs - Overview of Key Global Locations - Idea vs. Commercial Value - Transforming Ideas into Viable Business Models - Characteristics of Successful Business Ideas - Understanding Market Competition - Basics of Copyrights and Intellectual Property - Scalability in Business Ventures - Strategies for Scaling a Business

**UNIT IV HUMAN SKILLS FOR ENTREPRENEURSHIP 3**

Identifying and capitalizing on business opportunities - Case studies and anecdotes - Patience and Risk Management - The role of patience in entrepreneurial success and decision-making - Effective Communication - Techniques for clear and persuasive communication - Importance

of communication in building and leading teams - Leadership qualities and their impact on entrepreneurial ventures - Analyzing success and failure stories

**UNIT V FOUNDATIONS OF PERSONAL DEVELOPMENT AND WELL-BEING 3**

Understanding Life and Success - Self-Confidence and Fear - Practical strategies for enhancing self-esteem - Adolescent Issues - Health Management - Basics of a balanced diet - Benefits of physical activity - Scientific Heritage of India - Overview of India's scientific achievements and contributions - Cyber Crime Awareness - Types and prevention strategies.

**TOTAL: 15 PERIODS**

**COURSE OUTCOMES**

**Upon completion of the course, the students will be able to:**

CO1: Create study plans, value co-curricular activities, develop programming skills, and navigate for career advancement

CO2: Understand about higher education options, resume enhancement, project management, and securing internships

CO3: Learn entrepreneurship skills and strategies to develop successful business ideas.

CO4: Develop key entrepreneurial skills like opportunity recognition, risk management, and leadership through real-world examples

CO5: Explore personal development, health management, scientific heritage, and cybercrime awareness.

| Course Code | YOGA FOR STRESS MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| 24AC201 | | 0 | 0 | 1 | 0 |

**OBJECTIVES:**

**The course will enable the learners to:**

- Understanding the different types of stress and managing stress.
- Develop an understanding of practicing yoga
- Learning to do asanas, including sitting, standing and lying postures

**Unit I: Stress Management** **3**

Definition of Stress - Stress in Daily Life - Impact of Stress on Life - Identifying the Causes of Stress - Symptoms of Stress - Managing Stress (Habits, Tools, Training, Professional Help) - Complications of Stress Mismanagement - The Importance of Sleep for Mental Wellness - Connection Between Sleep and Digestion.

**Unit II: Introduction to Yoga** **3**

Meaning and Definition of Yoga - Aims and Objectives of Yoga - Guidelines for Practicing Asanas - Benefits of Yoga

**Unit III: Different Asanas** **3**

Methods of Performing Asanas - Pranayama - Suryanamaskar Asanas - Sitting Postures: Uttanpadasana, Paschimottanasana ,Janu Sirsasana , Baddha Konasana - Shishupal Asana - Vajrasana

**Unit IV: Standing Postures** **3**

Uttanasana -Trikonasana -Vrikshasana -Tadasana - Superbrain asana

**Unit 5: Lying Postures** **3**

Pavana Muktasana - Pada Sanchalanasana – Jhulana Lurhakanasana -Dhanurasana – Marjaryasana. BitilasanaDictionaries – Sorkuvai Project.

**TOTAL: 15 PERIODS**

**COURSE OUTCOMES:**

**Upon completion of the course, the students will be able to:**

CO1: relieve stress and achieve mental wellness.

CO2: experience the benefits of yoga

CO3: keep self and body healthy

**REFERENCE BOOK:**

1. Iyengar, Bellur Krishnamukar Sundara. "Light on yoga." (1965).

2. Desikachar, Tirumalai Krishnamacharya Venkata. The heart of yoga: Developing a personal practice. Simon and Schuster, 1999.

3. Davis, Martha, Elizabeth Robbins Eshelman, and Matthew McKay. The relaxation and stress reduction workbook. New Harbinger Publications, 2008.

4. Krishnamacharya, Tirumalai, et al. "Yoga makaranda: The nectar of yoga." Swathi Soft (2013).