R.M.D. ENGINEERING COLLEGE
(An Autonomous Institution)

REGULATIONS 2024
B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
CHOICE BASED CREDIT SYSTEM
CURRICULUM AND SYLLABI

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
SEMESTER – II
THEORY COURSE
1	24GE201	Tamils and Technology	HSMC	1	1	0	0	1
THEORY COURSES WITH LABORATORY COMPONENT
2	24MA202	Transforms and Complex Analysis (Lab Integrated)	BSC	5	3	0	2	4
3	24IT201	Data Structures and Algorithms (Lab Integrated)	ESC	6	3	0	3	4.5
4	24CS202	Java Programming (Lab Integrated)	ESC	6	3	0	3	4.5
5	24CH201	Chemistry for Electrical & Electronics Engineering (Lab Integrated)	BSC	5	3	0	2	4
6	24AM201	Introduction to Artificial Intelligence (Lab Integrated)	ESC	4	2	0	2	3
LABORATORY COURSE
7	24GE211	Idea Lab II	EEC	2	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSE
8	24HS211	Innovation and Creativity Skills Development	EEC	1	1	0	0	1
AUDIT COURSE
9	24AC201	Yoga for Stress Management (Non Credit)	AC	1	0	0	1	0
\multicolumn{4}{c}{TOTAL}	31	16	0	15	23

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 ancientTamil 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	TRANSFORMS AND COMPLEX ANALYSIS	L	T	P	C
24MA202	(Theory with Laboratory Component)	3	0	2	4

OBJECTIVES:

The course will enable the learners to:

- comprehend the concepts of Laplace transforms.
- understand the basic ideas of Z-Transforms.
- illustrate the application of transforms in solving differential and difference equations.
- understand the concepts of analytic functions and conformal mapping.
- impart the knowledge of complex integration.

UNIT I   LAPLACE TRANSFORMS   15

Laplace transforms – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions – Derivatives and integrals of transforms –Transforms of unit step function and impulse functions – Transform of periodic functions – Inverse Laplace transform – Convolution theorem (Statement only).

Experiments using C Program:

1. Find the Laplace Transform of simple functions.
2. Find the inverse Laplace Transform of simple functions.

UNIT II   Z – TRANSFORMS   15

Z-transforms – Elementary properties – Inverse Z-transforms – Partial fractions method – Residue method – Convolution theorem.

Experiments using C Program:

1. Find the Poles of X(z).
2. Resolve the X(z) by partial fraction method.

UNIT III SOLUTION OF DIFFERENTIAL AND DIFFERENCE EQUATIONS   15

Solution of linear ordinary differential equation of second order with constant coefficients and first order simultaneous equations with constant coefficients using Laplace transform. Formation of difference equations – Solution of first and second order difference equations with constant coefficients using Z-transform.

Experiments using C Program:

1. Find the solution of Ordinary Differential Equations.
2. Find the solution of Difference Equations.

UNIT IV   ANALYTIC FUNCTIONS   15

Analytic functions – Necessary and sufficient conditions in Cartesian coordinates (statement only) – Properties (only Cartesian coordinates) – Harmonic conjugates – Construction of an analytic function – Conformal mapping – Mapping by functions W= c+z, cz, 1/z – Bilinear transformation.

Experiments using C Language:

1. Compute Real and Imaginary Parts of the Exponential Function.
2. Compute the harmonic conjugate of a given function.

UNIT V   COMPLEX INTEGRATION   15

Cauchy's integral theorem (statement only) – Cauchy's integral formula (statement only) – Taylor's and Laurent's series – Singularities – Residues – Cauchy's Residue theorem (statement only) – Evaluation of real integrals using circular and semicircular contour (excluding poles on real axis).

Experiments using C Language:

1. Find the Taylor's series expansion of X(z) at any point.
2. Find the Residues of X(z).

TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1: determine Laplace transform and inverse Laplace transform of simple functions.

CO2: determine Z- transform and inverse Z- transform of simple functions.

CO3: solve ordinary differential equations using Laplace transform and difference equations using Z-Transform.

CO4: construct an analytic function and analyze conformal mapping.

CO5: evaluate the real integrals using complex integration.

CO6: identify singularities using Taylor's and Laurent's series.

TEXT BOOKS:

1. N. Bali, M. Goyal and C. Watkins, "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. B.S. Grewal, Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2021.

REFERENCES:

1. Erwin. Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. R.K. Jain and S.R.K Iyengar "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. R.C. Wylie and L.C. Barrett, "Advanced Engineering Mathematics", Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
4. M.K. Venkataraman, "Engineering Mathematics, Volume II", 4th Edition, The National Publication Company, Chennai, 2003.
5. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 6th Edition, New Delhi, 2008.
6. NPTEL course on "Transform Techniques for Engineers", by S.R.Manam, IIT Madras: https://archive.nptel.ac.in/courses/111/106/111106111/
7. NPTEL course on "Advanced Engineering Mathematics", by Prof. P. N. Agarwal, IIT Roorkee: https://onlinecourses.nptel.ac.in/noc23_ma90/preview

Course Code	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
24IT201		3	0	3	4.5

OBJECTIVES:

The Course will enable learners to:

- To understand the concepts of linear structures ADTs.
- To gain the knowledge of searching and sorting algorithms.
- To learn hashing algorithms and its applications.
- To understand the tree data structures.
- To understand graph structures.

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

Data Structures – Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation - circular linked list implementation - Double linked list implementation - Applications of linked lists. Stack: Operations, array and linked representations of stacks, stack applications. Queues: Operations, array and linked representations of Queue, Queue applications.

List of Exercise/Experiments:

1. Implementation of Singly, Doubly and Circular Linked List
2. Implementation of Stack using Arrays and Linked List
3. Implementation of Stack applications
4. Implementation of Queue using Arrays and Linked List
5. Implementation of Queue applications

UNIT II   SEARCHING AND SORTING ALGORITHMS   **9+9**

Searching: Linear and binary search, Sorting: Bubble sort, Insertion sort - Selection sort - Quick sort – Merge sort.

List of Exercise/Experiments:

Implementation of searching and sorting algorithms

UNIT III   TREES   **9+9**

Trees: Binary Tree - Terminology and Properties - Binary Search Tree - Insertion, Deletion, Traversal – In order, Preorder and Post order, Level order traversal, finding min and max, finding the kth minimum element in a BST

List of Exercise/Experiments:

1. Implementation of Binary Search Tree

UNIT IV   GRAPHS   **9+9**

Graphs – Representation - Traversal - BFS and DFS,Graph Algorithms: Minimum spanning Tree-Prims and Kruskal's, Shortest path algorithm - Dijkstra, Floyd and Warshall – Backtracking

List of Exercise/Experiments:

1. Implementation of Graph Traversal algorithms
2. Implementation of Minimum spanning tree algorithms

UNIT V   HEAPS AND HASHING   9+9

Heaps and Hashing - Implementation of Heaps, Binary Heap, Heap sort - Applications - Hash functions, open hashing-separate chaining, closed hashing - linear probing, quadratic probing, double hashing, random probing, rehashing

List of Exercise/Experiments:

1. Implementation of Hashing techniques
2. Implementation of Heap

TOTAL:45+45=90 PERIODS

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

CO1: Understand the concepts of basic data structures such as array and linked list.
CO2: Applying a suitable algorithm for searching and sorting.
CO3: Analyze the various tree algorithms for solving real time computing problems.
CO4: Understanding graph algorithms, operations, and applications
CO5: Understanding the importance of hashing.
CO6: Apply the appropriate data structure in context of solution of given problem.

TEXTBOOKS:

1. Thomas H. Cormen, C.E. Leiserson, R L. Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009.

2. Anany Levitin, Introduction to the Design and Analysis of Algorithms, 3rd edition, Pearson Education, 2021

REFERENCES:

1. Kurt Mehlhorn, and Peter Sanders – Algorithms and Data Structures - The Basic Toolbox, Springer - Verlag Berlin Heidelberg, 2008.
2. Debasis Samanta, "Classic Data Structures", Prentice Hall of India, 2nd edition, 2014.

LIST OF EQUIPMENTS:

Systems with Linux Operating System and GNU Compiler

Course Code	JAVA PROGRAMMING	L	T	P	C
24CS202	(Theory Course with Laboratory Component)	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	CHEMISTRY FOR ELECTRICAL AND ELECTRONICS ENGINEERING (Theory Course with Laboratory Component)	L	T	P	C
24CH201		3	0	2	4

OBJECTIVES:

The course will enable the learners

- To acquire knowledge on the fundamental principles of energy storage devices.
- To provide an overview of corrosion, its types and corrosion control methods.
- To gain insights into the basic concepts and applications of chemical sensors and cheminformatics.
- To identify the different types of smart materials and explore their applications in engineering and technology.
- To assimilate the preparation, properties and applications of nanomaterials in various fields.

UNIT I   ENERGY STORAGE DEVICES AND GREEN FUEL   15

Introduction to electrochemical cell and its terminology - electrochemical series and its applications.

Batteries – classification - construction and working principle -primary alkaline battery - secondary battery - Pb-acid battery.

Green fuel – Hydrogen - production (photo electrocatalytic and photo catalytic water splitting), construction, working principle and applications in H_2 -O_2 fuel cell.

Batteries used in E-vehicle: Ni-metal hydride battery, Li-ion battery- Recycling of Li-ion batteries by direct cycling method; environmental effects of different energy storage devices.

(Theory-9)

1. Construction of electrochemical cell.
2. Determination of discharging state of Pb-acid battery by estimating the strength of the acid correlates with specific gravity.
3. Study of performance of a battery using battery analyzing module.

(Laboratory-6)

UNIT II   CORROSION AND ITS CONTROL   15

Corrosion – causes of corrosion – principles of chemical corrosion – Pilling – Bedworth rule – principles of electrochemical corrosion – differences between chemical and electrochemical corrosion – factors influencing corrosion – types of corrosion – galvanic corrosion – differential aeration corrosion – stress corrosion– pitting corrosion, water line corrosion, impacts of corrosion on power plants.

Corrosion control and prevention – selection of materials and proper designing - cathodic protection – sacrificial anode — protective coatings - anodization, galvanization, anti-corrosive agents – molybdates and phosphates.

(Theory-9)

1. Determination of influence of pH on the rate of corrosion.
2. Demonstrate the effectiveness of the sacrificial anode in protecting the metal from corrosion.
3. Determination of corrosion rate at various % of NaCl - by weight loss method.

(Laboratory-6)

UNIT III CHEMICAL SENSORS AND CHEMINFORMATICS 15

Introduction - classification of chemical sensors -principle, construction and working of chemical sensors; pH sensor – Glass electrode; Breath analyzer; Industrial sensor – CO_2 sensors- sensor for health care – Glucose sensor.

Cheminformatics – definition, scope, and significance; applications in environmental sector – carbon footprint measurements, data analysis and interpretation.

(Theory-9)

1. Determination of the amount of given hydrochloric acid using a pH meter.
2. Calculate the carbon footprint from the provided dataset, analyze the results, and draw conclusions

(Laboratory-6)

UNIT IV SMART MATERIALS 15

Shape Memory Alloys: introduction - shape memory effect – functional properties of SMAs – types of SMA - Nitinol (Ni-Ti) alloy and its applications.

Chromogenic materials: introduction – types, applications in chemical and biological detection, display technologies, smart windows and light-modulating devices, biomedical and healthcare.

Smart Hydrogels – Introduction - Super Absorbent Polymers (SAP)- preparation, properties and applications of polyacrylic acid and sodium polyacrylate.

(Theory-9)

1. Demonstrate the shape memory effect using Nitinol wire.
2. Determination of pH sensitivity of bromothymol blue.
3. Determination of absorption efficiency of hydrogel by using kinetic study.

(Laboratory-6)

UNIT V NANO CHEMISTRY 15

Introduction – synthesis – top-down process (laser ablation, chemical vapor deposition), bottom-up process (precipitation, electrochemical deposition) – properties of nanomaterials – types –

nanotubes -carbon nanotubes, applications of CNT - nanocomposites – General applications of nanomaterials in electronics, information technology, medical and healthcare, energy, environmental remediation, construction and transportation industries.

(Theory-9)

1. Synthesis of nano $BaSO_4$ by precipitation method.
2. Demonstrate the efficiency of nano adsorbents in polluted water.

(Laboratory-6)

TOTAL: 75 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able

CO1: To identify the suitability of batteries for various fields.

CO2: To analyze the different types and impacts of corrosion, and evaluate methods for corrosion control and prevention.

CO3: To apply the fundamental principles of chemical sensors, cheminformatics and their applications across various industries.

CO4: To analyze the types of smart materials used in various engineering fields.

CO5: To explore the applications of nanomaterials in various fields, considering their advantages and limitations.

CO6: To integrate the concepts of chemistry for various engineering applications.

TEXTBOOKS:

1. P. C. Jain and Monika Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 19th Edition, 2024.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd reprint, 2012.

REFERENCES:

1. S.S. Dara and S.S. Umare, "A Textbook of Engineering Chemistry",S. Chand & Company, New Delhi, 12th Edition, 2022.
2. J. C. Kuriacose and J. Rajaram, "Chemistry in Engineering and Technology", Volume -1 & Volume -2, Tata McGraw-Hill Education Pvt. Ltd., 2010.

3. Barry A. Bunin, Brian Siesel, and J. Bajorath, "Chemoinformatics: Theory, Practice, & Products", Springer, First Edition, 2007.
4. Geoffrey A. Ozin, Andre C. Arsenault and Ludovico Cademartiri, "Nanochemistry: A Chemical Approach to Nanomaterials", RSC publishers, 2nd Edition, 2015.
5. J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas and B. Sivasankar, "Vogel's Quantitative Chemical Analysis", Pearson Education Pvt. Ltd., 6th edition, 2019.
6. Pierre R. Roverge, Handbook of Corrosion Engineering, McGraw-Hill Publishers, 3rd Edition, 2019.

7. NPTEL course on "Electrochemical Energy Storage"
Prof. Subhasish Basu Majumder, IIT Kharagpur,
https://onlinecourses.nptel.ac.in/noc21_mm34/preview

8. NPTEL course on "Corrosion Protection Methods"
Prof. Kallol Mondal, IIT Kanpur,
https://onlinecourses.nptel.ac.in/noc24_mm01/preview
9. NPTEL course on "Nanotechnology, Science and Applications"
Prof. Prathap Haridoss, IIT-M,
https://onlinecourses.nptel.ac.in/noc22_mm33/preview

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity
1.	Potentiometer	12 Nos.
2.	Conductivity meter	12 Nos.
3.	pH meter	12 Nos.
4.	CAN Enabled BMS unit	4 Nos.
5.	UV-Visible Spectrophotometer	2 Nos.

Course Code	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	L	T	P	C
24AM201	(Theory Course with Laboratory Component)	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	IDEA LAB – II	L	T	P	C
24GE211		**0**	**0**	**2**	**1**

OBJECTIVES:

Students completing this course are expected to

- Develop hands-on experience and practical application of theoretical knowledge.
- Develop their ability to explain the process involved.

LIST OF EXERCISES:

1. Printing of a 3D part.

2. Scanning of a 3D part.

3. Design and fabrication of press fit object using laser cutting machine.

4. Design and fabrication of 3D part using CNC Router.

5. Design and fabrication of simple PCB.

6. Soldering and desoldering of given electronic circuit.

TOTAL: 30 PERIODS

OUTCOMES:

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

CO1 Analyze the latest manufacturing methods in advancements and technologies related to their field.

CO2 Understand the operations of a laser cutting machine and CNC Router.

CO3 Analyze the process of design and fabrication of PCB and Soldering operations

CO4 Develop technical proficiency and problem-solving abilities, making more competent and confident in their field.

CO5 Develop themselves with the skills needed to address industry-specific problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No	Equipment Name	Quantity
1	CNC Router	1 No
2	3D Printer	1 No
3	3D Scanner	1 No
4	Laser cutting Machine	1 No
5	Multimeter	5 Nos
6	Solder Stations	5 Sets
7	Desoldering Machine	1 No
8	PCB Milling Machine	1 No
9	Variable Power Supply	1 No
10	Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc.	5 Sets

Course Code	INNOVATION AND CREATIVITY	L	T	P	C
24HS211	SKILLS DEVELOPMENT	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).