RVR & JC College of Engineering

CSE (AI & ML)

Semester II (First Year)

S. No.	Course Code	Course Title	Hours Per Week	Scheme of Examination			Category Code
			L – T – P	INT	EXT	Credits	
1	CM121	Mathematics – II	3 – 0 – 0	30	70	3	BS
2	CM122	Engineering Physics	3 – 0 – 0	30	70	3	BS
3	CM123	Digital Electronics	3 – 0 – 0	30	70	3	ES
4	CM 124	Data Structures & Algorithms	3 – 0 – 0	30	70	3	PC
5	CM125	Programming in Python	2 – 0 – 0	30	70	2	PC
6	CM161	Engineering Physics Lab	0 – 0 – 3	30	70	1.5	BS
7	CM 162	Technical Communication & Value Science Lab	0 – 0 – 3	30	70	1.5	HS
8	CM 163	Data Structures & Algorithms Lab	0 – 0 – 3	30	70	1.5	PC
9	CM 164	Programming in Python Lab	0 – 0 – 2	30	70	1	PC
10	CMMC2	Constitution of India	2 – 0 – 0	100	-	-	MC
		Total	16 – 0 –11	**370**	**630**	**19.5**	

Semester II (First year)

CM 121	Mathematics-II	L	P	C
		3	-	3

Course Objectives:

The objective of this course is to extend concepts developed in Calculus to functions of several variables of multivariable calculus and ordinary differential equations and to develop student understanding and skills in the topic necessary for its applications to science and engineering.

Course Outcomes:

The students will be able to:

1. Optimize functions of several variables essential in many engineering problems'.
2. Evaluate double and triple integrals and find areas and volumes.
3. Concepts like divergence, curl in integration of vector functions.
4. Solve differential equations which model physical processes.

Course Content:

UNIT – I 15 Periods

Multivariable Calculus: Limit, continuity and partial derivatives, total derivative Maxima, minima and saddle points of two variables, Method of Lagrange multipliers

UNIT – II 15 Periods

Multiple Integrals: Double integrals (Cartesian and polar), change of order of integration, change of variables (Cartesian to polar), area by double integration, triple integrals, volume by triple integrals.

UNIT – III 15 Periods

Scalar and vector point functions, Gradient, directional derivative, divergence and curl, del applied twice to point and product of point functions (without proofs) Vector integration: line integral, surface and volume integrals, Green's theorem (without proof), Stoke's theorem (without proof), Gauss divergence theorem (without proof).

UNIT – IV 15 Periods

First order ordinary differential equations: Linear, Bernoulli and exact equations Second order ordinary linear equations: Solution by method of variation of parameters, Cauchy's equation, Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Learning Resources:

Text Book:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd edition.

Reference Books:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2010.
2. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.

CM 122	Engineering Physics	L	P	C
		3	-	3

Course Objectives:

1. Introducing the concept of electron motion in periodic potentials and classification of solids, band formation by learning the prerequisite quantum physics.
2. Explaining the diode equation and formation of P-N junction from the basics of semiconductors.
3. Understanding the interaction of radiation with bulk semiconductors and the relevant Optoelectronic devices with energy band diagrams.
4. Exploring the applications of devices in low dimensional materials by understanding the density of states and experimental techniques to be used for measurement of transport properties.

Course Outcomes:

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

1. Demonstrate the necessity of periodical potentials and conditions for explaining the properties and band formation with the help of quantum physics.
2. Understand the theory of P-N junction diode from the basics of semiconductor concepts.
3. Know the theory and application of Optoelectronic devices.
4. Describe measuring techniques employed in transport phenomena and variation of properties in low dimensions.

Course Content:

UNIT – I		15 Periods
Principles of Quantum Mechanics: Wave nature of particles, de Broglie's hypothesis, Davisson and Germer's experiment, Time dependent and Time independent Schrodinger wave equations, Physical significance of wave function, Uncertainty principle, single slit experiment. Particle in a box and extension to 3D box (qualitative treatment only). **Electron Theory of Metals**: Salient features of Free electron theory, Fermi - Dirac distribution function, Fermi level, Density of States, Bloch wave function, Kronig-Penney model, E-k curves, Brillouin zones, Effective mass, Degrees of freedom, Distinction of metals, semiconductors and insulators. Concept of hole, Energy band formation insolids.		
UNIT – II		15 Periods
Semiconductor Physics: Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, drift and diffusion equations, Einstein's relation, P-N junction formation, diode equation, Hall effect and applications.		
UNIT – III		15 Periods
Lasers and Optoelectronic Devices: Direct and Indirect band gap semiconductors, Light-semiconductor interaction: Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission, Optical loss and gain; Density of states for		

photons, Semiconducting laser, Homo and Hetero structure lasers with band diagrams, characteristics of laser and LED,PIN diode, Solar cell , working principle and characteristics.		
UNIT – IV		15 Periods
Low Dimensional Structures and Measuring Techniques: Density of states in 2D, 1D and 0D (qualitatively). Practical examples of low-dimensional systems such as quantum wells, wires, and dots. Four-point probe and Van der Pauw measurements for carrier density, resistivity and Hall mobility, Hot-point probe measurement, capacitance-voltage measurements, Parameter extraction from Diode I-V characteristics.		

Learning Resources:

Text Book:

1. M.N. Avadhanulu, P.G. Kshirasagar - A Text book of Engineering Physics, S. Chand & Company Ltd., 2018.

Reference Book(s):

1. Donald A.Neeman - Semiconductor Physics and Device : Basic Principle (Fourth edition), TMH, 2012.
2. J.Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
3. B.E.A.Saleh and M.C.Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
4. S.M.Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
5. A.Yariv and P.Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
6. P.Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).

Web Resources:

1. Online course: ''Semiconductor Optoelectronics'' by M R Shenoy on NPTEL.
2. Online course: ''Optoelectronic Materials and Devices'' by Monica Katiyar and Deepak Gupta on NPTEL.

CM 123	Digital Electronics	L	P	C
		3	-	3

Course Objectives:

The main objectives of this course are

1. Know the concepts of different number systems, conversions and functionality of logic gates.
2. To analyse and design combinational logic circuits.
3. To analyse and design sequential logic circuits.
4. Understand programmable logic devices.

Course Outcomes:

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

1. Demonstrate the knowledge in number systems, Boolean algebra, Combinational, sequential circuits, Programmable logic devices and Logic families.
2. Analyse and Design various combinational Circuits.
3. Analyse and Design various sequential Circuits.
4. Implement combinational circuit functionality with Programmable logic devices.

Course Content:

UNIT – I **CO1, CO2, CO3, CO4** 12 Periods

Digital Systems: Digital Systems, Binary Numbers, Number-Base Conversions, Octal and Hexadecimal Numbers, complements, signed binary Numbers. Codes: BCD, excess – 3, Gray.

Boolean Algebra & Logic Gates: Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic theorems and Properties of Boolean Algebra, Boolean functions, Canonical and Standard Forms, Digital Logic gates.

Gate-Level Minimization: The Map Method, Four-Variable K-Map, Five-Variable K-Map, Product of sums simplification, Don't-Care conditions, NAND and NOR implementation.

UNIT – II **CO1, CO2, CO3** 12 Periods

Combinational Logic: Combinational Circuits, Analysis Procedure, Design procedure, Half adder, Full adder, Half subtractor, Full subtractor, Carry look ahead adder, Magnitude comparator, Encoders, Decoders, Multiplexers, Demultiplexers**.**

UNIT – III **CO1, CO2, CO3** 12 Periods

Synchronous and sequential Logic: Sequential circuits, Latches, Flip-Fops, Analysis of clocked Sequential circuits, State Reduction and Assignment, Design Procedure.

UNIT – IV **CO1, CO4** 12 Periods

Registers and Counters: Registers, Shift Registers, Ripple Counters, Synchronous Counters.
Programmable Logic Devices: Programmable Read-Only Memory, Programmable Logic Array, Programmable Array Logic.

Learning Resources:

Text Books:

1. M. Morris Mano, Digital Design, 3rdEdition, Pearson Education, 2009

Reference Books:

1. Z. Kohavi - Switching and Finite Automata Theory,2nd Edition Tata McGraw Hill.
2. 2. R.P. Jain - Modern digital electronics, 4thEdition, McGraw Hill.

Web Resources:

1. http://nptel.ac.in/courses/117105080/3
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-111- introductory

CM 124	Data Structures & Algorithms	L	P	C
		3	-	3

Course Pre Requisite(s): Basic understanding of C programming language Course

Course Objective:

1. To illustrate operations of linear and non-linear data structure
2. To demonstrate computational problems using suitable data structures
3. To familiarize searching and sorting techniques

Course Outcome(s):

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

1. Analyze complexity of algorithms.
2. Implement various data structures and its operations.
3. Compare various sorting and searching methods.
4. Apply data structures in various applications.

Course Content:

UNIT – I Text Books – 1 & 2 15 Periods

Basic Terminologies and Introduction to Algorithm & Data Organization: Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction
Linear Data Structure: Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures

UNIT – II Text Books – 1 & 2 13 Periods

Non-linear Data Structure: Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+Tree, AVL Tree, Splay Tree) and Graphs (Directed, Undirected), Various Representations, Operations & Applications of Non-Linear Data Structures

UNIT – III Text Book - 2 12 Periods

Searching and Sorting on Various Data Structures: Sequential Search, Binary Search, Comparison Trees, Breadth First Search, Depth First Search Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heap sort, Introduction to Hashing

UNIT – IV Text Book – 2 & Reference Book-4 10 Periods

File: Organization (Sequential, Direct, Indexed Sequential, Hashed) and various types of accessing schemes.
Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Learning Resources:

Text Books:

1. Fundamentals of Data Structures, E. Horowitz, S. Sahni, S. A-Freed, Universities Press.
2. Data Structures and Algorithms, A. V.Aho, J. E.Hopperoft, J. D.UIlman, Pearson.

Reference Books:

1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E.Knuth.
2. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest,Clifford Stein, The MITPress.
3. Open Data Structures: An Introduction (Open Paths to Enriched Learning), (Thirty First Edition), Pat Morin, UBCPress.

CM 125	Programming in Python	L	P	C
		2	-	2

OBJECTIVES:

The objectives of the course are to:

1. Introduce the fundamentals of Python Programming language.
2. Teach students processing of files, mutable and immutable data types.
3. Impart knowledge of Object – Oriented Programming using Python.

OUTCOMES:

Upon completion of the course, students will be able to

CO 1. Explain the fundamentals of Python programming language.
CO 2. Create user defined functions to solve problems
CO 3. Manipulate the data structures lists, tuples, sets and dictionaries
CO 4. Use Exception handling and Object – Oriented programming features of Python in solving real world problems

UNIT – I 10 Periods

The way of the program: What is a program? Running Python, The first program, Arithmetic operators, Values and types

Variables, expressions and statements: Assignment statements, Variable names, Expressions and statements, Script mode, Order of operations, String operations. Functions: Function calls, Math functions, Composition, adding new functions, Definitions and uses, Flow of execution, Parameters and arguments, Variables and parameters are local, Stack diagrams, Fruitful functions and void functions, Why functions.

Conditionals and recursion: Floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Recursion, Stack diagrams for recursive functions, Infinite recursion, Keyboard input.

UNIT – II 10 Periods

Fruitful functions: Return values, Incremental development, Composition, Boolean functions, More recursion, Checking types.

Iteration: Reassignment, Updating variables, The while statement, break, Square roots.

Strings: A string is a sequence, len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and counting, String methods, The in operator, String comparison.

Files: Persistence, Reading and writing, Format operator, Filenames and paths, Catching exceptions, Databases, Pickling, Pipes, Writing modules**.**

UNIT – III 10 Periods

Lists: A list is a sequence, Lists are mutable, traversing a list, List operations, List slices, List methods, Map, filter and reduce, deleting elements, Lists and strings, Objects and values, Aliasing, List arguments.

Dictionaries: A dictionary is a mapping, Dictionary as a collection of counters. Looping and dictionaries, Reverse lookup, Dictionaries and lists, Memos, Global variables.

Tuples: Tuples are immutable, Tuple assignment, Tuples as return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples.

UNIT – IV 10 Periods

Classes and objects: Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying.

Classes and methods: Object-Oriented features, Printing objects, The init method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation.

Inheritance: Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Data encapsulation.

Learning Resources:

TEXT BOOKS:

1. ThinkPython: How to Think Like a Computer Scientist, Allen Downey, Green Tea Press, Version2.0.17

REFERENCES:

1. Introduction to Computer Science Using Python: A Computational Problem-Solving Focus by Dierbach, Wiley
2. Fundamentals of Python Programming: Richard L. Halterman by Southern Adventis tUniversity

CM 161	Engineering Physics Lab	L	P	C
		-	3	1.5

Course Objectives:

The aim and objective of the Lab course on Physics is to introduce the students of B.Tech. class to the formal structure of Physics so that they can use these in Engineering as per their requirement.

1. To familiarize the students with electronic measuring instruments.
2. To measure various parameters of the optical components.
3. Design/problem solving skills, practical experience is developed through laboratory assignments which provide opportunities for developing team in multidisciplinary environments.
4. To understand the general, scientific concepts and a wide idea on various components &instruments required for technology.

Course Outcomes:

At the end of the course, the student will be to draw:

CO 1. Use CRO, Function generator, Spectrometer for making measurements.
CO 2. Test the optical instruments using principles of interference and diffraction.
CO 3. Carrying out precise measurements and handling sensitive equipment.
CO 4. Draw conclusions from data and develop skills in experimental design.

List of Experiments:

1. Measurements using Vernier Calipers, Screw Gauge and Spherometer.
2. Newton's rings - Measurement of radius of curvature of plano-convex lens.
3. Determination of Energy band gap of a Semiconductor.
4. Optical fibers – Determination of Numerical Aperture.
5. Diffraction grating - Measurement of wavelengths using Spectrometer.
6. Magnetic field in Helmholtz coil.
7. PhotoVoltaic Cell – Determination of fill factor.
8. Series LCR resonance circuit –Determination of Q – factor.
9. Four probe method apparatus for measurements of resistivity and conductivity
10. Determination of wavelengths using diffraction grating
11. Variation of magnetic field along the axis of a circular current carrying coil
12. Carey Foster's bridge – Determination of Specific Resistance

Reference Book:

Physics Lab Manual: RVR & JCCE, Guntur

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

CM 162	Technical Communication & Value Science Lab	L	P	C
		-	3	1.5

Nature of Course: Behavioural
Course Pre Requisites: Basic Knowledge of Intermediate English

Course Objectives:
The course aims at making learners:

- understand human values and their importance in leading a holistic life
- inspect own strengths and opportunities
- learn key concepts of technical communication
- develop communicative writing and speaking skills

Course Outcomes:
By the end of the course, learners will be able to:

CO1. imbibe life skills and values in day-to-day life
CO2. create a better version of self
CO3. demonstrate the basic tenets of technical communication
CO4. apply technical communication practices in real life

List of experiments/demonstrations:

UNIT-I: Understanding Human Values

Values to be learnt - leadership, teamwork, dealing with ambiguity, managing stress, motivating people, creativity, result orientation
Life skills - Community service, taking up social initiatives, branding a cause
Activity - Narrating a story on values, taking part in an outreach activity, immersion interviews

UNIT-II: Knowing Self

Introducing self: Activity on self-introduction, introducing others, SWOT analysis
Self-awareness: Identity, body awareness, stress management
Expressing self: Knowing self, visualizing and experiencing purpose
Activity: creating vision board, an avataar with describing words

UNIT-III: Overview of Technical Communication

Reflective Listening: Importance and practice
Vocabulary Enrichment: Academic word list (AWL), technical jargon and transitions
Communicative Writing: e mails, formal letters and micro blogs
Activity: Drafting micro blogs, emails and letters

UNIT-IV: Communicative Speaking

Communication Prerequisites: Content, tone and body language
Celebrity Interviews: Art of questioning and eliciting information
Picture Description: Procedure and perception
Group Discussions: Table topics and practice
Activity: Micro teams peer assessment with metric chart

Reference Books

1. English vocabulary in use – Alan Mc'carthy and O'dell
2. APAART: Speak Well 1 (English language and communication)
3. Abundance: The Future is Better Than You Think; Peter H. Diamandis and Steven Kotler; Published: 21 Feb, 2012; Publisher: Free Press
4. The Family and the Nation; Dr. A.P.J Abdul Kalam; Publishing year: 2015; Co-author: Acharya Mahapragya
5. Business Communication – Dr. Saroj Hiremath

Web References

1. Train your mind to perform under pressure- Simon sinek https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-underpressure-capture-your-flag/
2. Will Smith's Top Ten rules for success https://www.youtube.com/watch?v=bBsT9omTeh0
3. Examples of Technical Writing for Students:https://freelance-writing.lovetoknow.com/kinds-technical-writing
4. 11 Skills of a Good Technical Writer: https://clickhelp.com/clickhelp-technical-writing-blog/11-skills-of-a-good-technical-writer/

CM 163	Data Structures & Algorithms Lab	L	P	C
		-	3	1.5

Course Description and Objectives:

The course is designed to develop skills to design and analyze simple linear and nonlinear data structures. It strengthens the ability to the students to identify and apply the suitable data structure for the given real world problem. It enables them to gain knowledge in practical applications of data structures.

Course Outcomes:

At the end of this lab session, the student will

CO1. Be able to design and analyze the time and space efficiency of the data structure.

CO2. Be capable to identity the appropriate data structure for given problem.

CO3. Have practical knowledge on the applications of data structures.

CO4. Have practical knowledge on handling data structures with files.

Laboratory

1. Towers of Hanoi using user defined stacks.
2. Reading, writing, and addition of polynomials.
3. Line editors with line count, word count showing on the screen.
4. Trees with all operations.
5. All graph algorithms.
6. Saving / retrieving non-linear data structure in/from a file

CM 164	Programming in Python Lab	L	P	C
		0	2	1

Course Objectives:

The objectives of the course are:

1. To introduce the fundamentals of Python Programming language.
2. To make the students process files, mutable and immutable data.
3. To impart knowledge of Object – Oriented Programming using Python

Course Outcomes:

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

CO 1. Illustrate the fundamentals of Python programming language.
CO 2. Create user defined functions to solve problems
CO 3. Write programs to manipulate the data structures lists, tuples, sets and dictionaries
CO 4. Use Exception handling and Object – Oriented programming features of Python in solving real-world problems.

List of Exercises / Activities:

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Lab1 Simple Programs to demonstrate Input - Output operations.
Lab2 Programs to demonstrate the behavior and use of various operators.
Lab3 Programs to emphasize the usage of Conditional Control Statements.
Lab4 Programs to emphasize the usage of Iterative control statements.
Lab5 Programs on the usage of Built-in functions.
Lab6 Programs to demonstrate the creation and usage of User Defined Functions.
Lab7 Programs to demonstrate Recursion.
Lab8 Programs on creation and importing of modules.
Lab9 Programs on Lists and its operations
Lab10 Programs on List Processing. (Sortings, Searchings, Permutations...)
Lab11 Programs to demonstrate Exception Handling.
Lab12 Programs to demonstrate OOP concepts.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

CM MC02	Constitution of India	L	P	C
		2	-	-

Course Objective:

To provide basic information about Indian Constitution.

Course Outcomes:

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

CO 1. Understand the significance of many provisions of the Constitution as well as to gain insight into their back ground. They will also understand number of fundamental rights subject to limitations in the light of leading cases.

CO 2. Study guidelines for the State as well as for the Citizens to be followed by the State in the matter of administration as well as in making the laws. It also includes fundamental duties of the Indian Citizens in Part IV A (Article 51A).

CO 3. Understand administration of a State, the doctrine of Separation of Powers.

CO 4. Know how the State is administered at the State level and also the powers and functions of High Court.

CO 5. Understand special provisions relating to Women empowerment and also children. For the stability and security of the Nation, Emergency Provision are Justified.

CO 6. Understand election commission as an independent body with enormous powers and functions to be followed both at the Union and State level. Amendments are necessary, only major few amendments have been included.

Course Content:

UNIT – I 10 Periods

Preamble to the Constitution of India Domicile and Citizenship. Fundamental rights under Part III, Leading Cases. Relevance of Directive Principles of State Policy under Part-IV, IV-A Fundamental duties.

UNIT – II 10 Periods

Union Executive - President, Vice-President, Prime Minister, Union Legislature - Parliament and Union Judiciary - Supreme Court of India. State Executive - Governors, Chief Minister, State Legislature and High Court.

UNIT – III 10 Periods

Special Constitutional Provisions for Scheduled Casters and Tribes, Women and Children and Backward Classes, Emergency Provisions.

UNIT – IV 10 Periods

Electoral process, Centre State Relations (Amendment Procedure, 42nd, 44th, 74th, 76th, 86th and 91st Constitutional amendments).

Learning Resources:

Text Book:

1. Durga Das Basu, Introduction to the Constitution of India'' (student edition) Prentice - Hall EEE,19th/20th Edition, 2001.

Reference Books:

1. M.V. Pylee, ''An Introduction to Constitution of India'', Vikas Publishing, 2002.

2. Brij Kishore Sharma, ''Introduction to the Constitution of India'', PHI, Learning Pvt.Ltd., New Delhi,2011.