KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C. Nagar, K.Vellakulam – 625 701 (Near VIRUDHUNAGAR).

B.E. COMPUTER SCIENCE AND ENGINEERING

REGULATION – 2021

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM

III TO IV SEMESTER CURRICULUM AND SYLLABI

VISION:

To make the Department of Computer Science and Engineering the unique of its kind in the field of Research and Development activities in this part of world.

MISSION:

To impart highly innovative and technical knowledge to the urban and unreachable rural student folks in Computer Science and Engineering through "Total Quality Education".

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1: Apply the necessary mathematical tools and fundamental knowledge of computer science & engineering to solve variety of engineering problems.

PEO 2: Develop software based solutions for real life problems and be leaders in their profession with social and ethical responsibilities.

PEO 3: Pursue life-long learning and research in selected fields of computer science & engineering and contribute to the growth of those fields and society at large.

PROGRAM OUTCOMES:

After going through the four years of study, the Computer Science and Engineering graduates will have the ability to

POs	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/Development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1 : Professional Skills: The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

PSO2 : Problem - Solving Skills: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

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REGULATION - 2021

CHOICE BASED CREDIT SYSTEM

B.E. COMPUTER SCIENCE AND ENGINEERING

CURRICULUM AND SYLLABI FOR SEMESTER III TO IV

SEMESTER III

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA2201	Linear Algebra and Boundary Value Problems	BS	4	3	1	0	4
2	IT2201	Computer Organization and Architecture	PC	3	3	0	0	3
3	CS2201	Data Structures using Python	PC	3	3	0	0	3
4	CS2202	Object Oriented Programming using Java[#]	PC	4	2	0	2	3
5	CS2203	System Software and Operating Systems	PC	3	3	0	0	3
6	EC2201	Digital System Design and Microprocessors	ES	4	3	1	0	4
7		Audit Course	AU	3	3	0	0	0
PRACTICALS								
8	CS2204	Data Structures using Python Laboratory	PC	3	0	0	3	1
9	EC2202	Digital System Design and Microprocessors Laboratory	ES	4	0	0	4	2
			TOTAL	**31**	**20**	**2**	**9**	**23**

[#] **Theory cum Laboratory Course**

SEMESTER IV

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA2251	Discrete Mathematics and Probability	BS	4	3	1	0	4
2	CS2251	Database Management Systems	PC	3	3	0	0	3
3	CS2252	Design and Analysis of Algorithms	PC	3	3	0	0	3
4	CS2253	Software Engineering with UML Design	PC	3	3	0	0	3
5	AI2201	Artificial Intelligence	PC	3	3	0	0	3
6	GE2201	Design Thinking	ES	3	3	0	0	3
7	GE2251	Quantitative Aptitude	EM	1	1	0	0	1
PRACTICALS								
8	CS2254	Database Management Systems Laboratory	PC	4	0	0	4	2
9	CS2255	Mobile Application Development Laboratory	PC	4	0	0	4	2
10	EM2252	An Introduction to Advanced Reading and Writing	EM	2	0	0	2	1
			TOTAL	**30**	**19**	**1**	**10**	**25**

Course Code	Course Name	L	T	P	C
MA2201	LINEAR ALGEBRA AND BOUNDARY VALUE PROBLEMS	3	1	0	4

Category: Foundation Courses (Basic Science Courses)

a. Preamble

The operations of addition and scalar multiplication are used in many diverse contexts in mathematics. The general theory of mathematical systems involving addition and scalar multiplication has the applications to many areas of Engineering. Mathematical systems of this form are called vector spaces or linear spaces. Subject to certain given conditions, called boundary conditions, solving partial differential equation is known as solving a boundary value problem. It is also applied in many Engineering field.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Test the given system of equation is linearly dependent or independent.	K3
CO2	Apply the concept of Eigen values and Eigen vectors for diagonalization of a matrix.	K3
CO3	Apply the inner product techniques for finding the orthonormal vector and minimal solution to the system of linear equation.	K3
CO4	Apply the Fourier series techniques in solving wave and heat flow equations.	K3
CO5	Solve Initial and Boundary value problems numerically.	K3

c. Course Syllabus **Total : 60 Periods**

VECTOR SPACES **12**

Vector spaces – Subspaces – Linear combinations of vectors – Linear Span – Linear independence and linear dependence – Bases and dimensions.

LINEAR TRANSFORMATION AND DIAGONALIZATION **12**

Linear transformation – Null space and range space – Dimension theorem (proof excluded) – Matrix representation of a linear transformation – Eigen values and eigen vectors – Diagonalization of linear transformation – Applications.

INNER PRODUCT SPACES **12**

Inner products spaces – Orthogonal vectors – Gram Schmidt orthogonalization process (proof excluded) – Orthogonal complement – Least square approximation – Minimal solution to system of linear equations..

FOURIER SERIES AND BOUNDARY VALUE PROBLEMS **12**

Dirichlet's conditions – General Fourier series – Half range sine series – Half range cosine series – Classification of Partial differential equations – Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction.

NUMERICAL SOLUTION OF BOUNDARY VALUE PROBLEMS **12**

Difference operators – Finite difference solution of second order ordinary differential equation – Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – Numerical solution of Parabolic: Crank Nicholson and Bender Schmidt method.

d. Activities

Students shall be exposed to MATLAB programming to solve simple problems in Diagonalization.

e. Learning Resources

Text Books

1. Friedberg, A H, Insel, A J, and Spence, L, *Linear Algebra*, Prentice Hall of India, New Delhi, 2004.
2. Grewal, B S, *Higher Engineering Mathematics*, 44th Edition, Khanna Publishers, New Delhi, 2020.
3. Grewal, B S, and Grewal, J S, *Numerical Methods in Engineering and Science*, Khanna Publishers, 10th Edition, New Delhi, 2016.

Reference Books

1. Kolman, B and Hill, D R, *Introductory Linear Algebra*, Pearson Education, New Delhi, 1st Reprint, 2009.
2. Strang G, *Linear Algebra and its applications*, 4th Edition, Cengage learning India pvt. Ltd, 2012.
3. Glyn James, *Advanced Modern Engineering Mathematics*, Pearson Education, 4th Edition, New Delhi, 2011.
4. Peter V, O'Neil, *Advanced Engineering Mathematics*, Cengage Learning India Pvt., Ltd., 7th Edition, New Delhi, 2012.

5. Kandasamy, P, Thilagavathy, K and Gunavathy, K, *Numerical Methods*, 3rd Edition Reprint, S. Chand & Co. Ltd., New Delhi, 2014.

Course Code	Course Name	L	T	P	C
IT2201	COMPUTER ORGANIZATION AND ARCHITECTURE	3	0	0	3

Category: Professional Core Course

a. Preamble

This course enables the students to understand the basic structure, operations and instructions of a digital computer. This course helps the students to learn the implementation of fixed point and floating-point arithmetic operations. This course makes students familiar with the basic processing unit and multiple functional units in a processor. This course enables the students to understand the hierarchical memory system and I/O organization. This course focuses the concepts of instruction level parallelism, data level parallelism and loop level parallelism.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Summarize the functionalities of various parts, instruction sets and operations of a digital computer	K2
CO2	Utilize the logic design for fixed-point and floating point arithmetic	K3
CO3	Interpret the role of a processing unit and multiple functional units.	K3
CO4	Explain the various elements in memory hierarchy and the basic and complex I/O structures.	K2
CO5	Demonstrate how parallelism is used at instruction-level and data-level parallelism.	K2

c. Course Syllabus **Total : 45 Periods**

BASIC STRUCTURE OF COMPUTERS **9**

Functional Units – Basic Operational Concepts – Bus Structures – Software – Performance: Processor Clock, Basic Performance Equation, Clock Rate – Instruction Set: CISC and RISC – Memory Locations and Addresses – Memory Operations – Instructions and Instruction Sequencing – Addressing Modes – Basic Input/output Operations.

ARITHMETIC UNIT **9**

Addition and Subtraction of Signed Numbers – Design of Fast Adders – Multiplication of Positive Numbers – Signed Operand Multiplication – Fast Multiplication – Integer Division – Floating Point Numbers and Operations.

PROCESSING UNIT **9**

Basic Processing Unit: Fundamental Concepts – Execution of a complete instruction – Multiple-bus organization – Hardwired Control – Microprogrammed control – Pipelining: Basic Concepts – Data Hazards – Instruction Hazards – Datapath and Control Considerations.

MEMORY SYSTEMS & INPUT / OUTPUT ORGANIZATION **9**

Memory Systems: Basic Concepts – Cache Memories – Performance Considerations – Virtual Memories – Memory Management Requirements – Secondary Storage – Input / Output Organization: Accessing I/O Devices – Interrupts – Direct Memory Access – Buses – Synchronous Bus – Asynchronous Bus.

PARALLEL PROCESSING **9**

Instruction-Level Parallelism: Concepts and Challenges – Basic compiler techniques for exposing ILP – Overcoming Data Hazards with Dynamic Scheduling – Dynamic Scheduling: Examples and the Algorithm – Data-Level Parallelism: Introduction – Vector Architecture – Graphics Processing Units – Detecting and Enhancing Loop-Level Parallelism.

d. Activities

Students shall be involved in various activities to improve conceptual learning:

i. Solving problems

ii. Chart work

iii. Quiz

e. Learning Resources

Text Book

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, *Computer Organization and Embedded Systems*, 6th Edition, Tata McGraw Hill, 2012.

Reference Books

1. David A Patterson and John L Hennessy, *Computer Organization and Design: The Hardware/Software Interface*, 5th Edition, Morgan Kaufmann / Elsevier, 2014.

2. William Stallings, *Computer Organization and Architecture – Designing for Performance*, 8th Edition, Pearson Education, 2010.
3. John P Hayes, "*Computer Architecture and Organization*, 3rd Edition, Tata McGraw Hill, 2012.

Course Code	Course Name	L	T	P	C
CS2201	DATA STRUCTURES USING PYTHON	3	0	0	3

Category: Professional Core Course

a. Preamble

This course enables the students to understand the importance of data structures to solve the real-time problems. This course focuses on introduction to design, analysis, and implementation of data structures using Python programming language..

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Explain about the basic concepts of linear data structures	K2
CO2	Outline the usage of linear data structures like stacks and queues in program design	K2
CO3	Infer knowledge about tree data structure and its applications	K2
CO4	Summarize about different graph traversal methods and applications of graphs	K2
CO5	Make use of appropriate searching, sorting and hashing techniques for solving a problem	K3

c. Course Syllabus **Total : 45 Periods**

LINEAR DATA STRUCTURES **9**

Basic concepts: Introduction to data structures - classification of data structures - operations on data structures - Introduction to Linear and Non Linear data structures -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).

LINEAR DATA STRUCTURES – STACKS AND QUEUES **9**

Stack ADT – Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT – Operations - Circular Queue – Priority Queue - deQueue – applications of queues.

NON LINEAR DATA STRUCTURES – TREES **9**

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree - Heap – Applications of heap.

NON LINEAR DATA STRUCTURES - GRAPHS **9**

Graphs: Basic concept - Graph Representations: Adjacency matrix, Adjacency lists -Types of graph – Graph traversals: Breadth-first traversal, Depth-first - traversal - Application of graphs - Topological Sort – Bi-connectivity – Cut vertex – Euler circuits -Minimum spanning trees – Prims and Kruskal algorithms.

SEARCHING, SORTING & HASHING TECHNIQUES **9**

Searching - Linear Search - Binary Search. Sorting - Bubble sort - Selection sort -Insertion sort - Quick sort - Merge Sort - Comparison of sorting algorithms – Hashing - Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

d. Activities

Students shall be exposed to the need of data structures and types to solve simple problems using python.

e. Learning Resources

Text Books

1. Benjamin Baka, David Julian, *Python Data Structures and Algorithms*, Packt Publishers, 2017.
2. Shriram K. Vasudevan, Abhishek S Nagarajan, Karthick Nanmaran, *Data Structures using Python*, Oxford University Press, India, 2021.

Reference Books

1. Rance D Necaise, *Data Structures and Algorithms using Python*, Wiley Student Edition, 2011.
2. Lipschutz, S, *Data Structures*, 1st Edition, Tata McGraw Hill Education, 2008.
3. Samanta, D, *Classic Data Structures*, 2nd Edition, PHI Learning, 2004.

Course Code	Course Name	L	T	P	C
CS2202	OBJECT ORIENTED PROGRAMMING USING JAVA	2	0	2	3

Category: Professional Core Course (Theory cum Lab)

a. Preamble

This course enables the students to understand the importance of object oriented programming concepts to solve the real-time challenges using JAVA. This course enriches the knowledge of logical skills and problem solving skills.

b. Course Outcome (Theory)

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

CO. No.	Course Outcome	Knowledge Level
CO1	Explain the Java language basic constructs	K2
CO2	Illustrate the concepts of classes and objects	K2
CO3	Demonstrate inheritance and interfaces in Java	K2
CO4	Apply exception handling and file handling mechanism to write simple applications in Java	K3
CO5	Build simple Java applications using threads and generic class	K3

Course Outcome (Lab)

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

CO. No.	Course Outcome	Knowledge Level
CO1	Develop simple Java programs using string and class	K3
CO2	Build object oriented programs using Java Inheritance, Interface and Abstract class	K3
CO3	Develop Java applications using file handling and multithreading	K3
CO4	Construct a simple generic function in Java	K3
CO5	Build database driven Java application using JDBC	K3

c. Course Syllabus **Total : 60 Periods**

INTRODUCTION TO OOPS AND JAVA FUNDAMENTALS **6**

Object Oriented Programming Concepts – Fundamental Programming Structures in Java – Data Types – Variables and Constants – Operators – Control Flow Statements.

CLASSES AND OBJECTS **6**

Arrays – Strings – Defining Classes and Objects – Methods – Constructors.

INHERITANCE AND INTERFACES **6**

Inheritance – Super classes & Sub classes – Types of Inheritance – Abstract classes and methods – Final classes and methods – Interfaces.

EXCEPTION AND FILE HANDLING **6**

Exceptions – Built-in Exceptions – Creating own exceptions – Input / Output Streams Basics – Byte streams and Character streams.

MULTITHREADING AND GENERIC PROGRAMMING **6**

Thread life cycle – Creating threads – Thread Synchronization – Generic classes – Generic methods - JDBC.

LIST OF LABORATORY EXPERIMENTS **30**

1. Develop a Java application to generate Electricity bill using Classes and Objects.
2. Develop a program to perform string operations using ArrayList.
3. 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% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4. Design a Java interface for Stack ADT Operations.
5. 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 only the method print Area () that prints the area of the given shape.
6. Develop a Java application for file handling using IO Stream Classes.

7. Implement a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
8. Develop a Java program to find the maximum value from the given type of elements using a generic function.
9. Develop a Java application using JDBC.

d. Activities

Students shall be exposed to object oriented programming concepts and to solve simple problems using Java.

e. Learning Resources

Text Books

1. Herbert Schildt, *Java The complete reference*, 11th Edition, McGraw Hill Education, 2019.
2. Cay S Horstmann & Gary cornell, *Core Java Volume – I Fundamentals*, 9th Edition, Prentice Hall, 2013.

Reference Books

1. Paul Deitel and Harvey Deitel, *Java SE 8 for programmers*, 3rd Edition, Pearson, 2015.
2. Steven Holzner, *Java 2 Black book*, Dreamtech press, 2011.
3. Timothy Budd, *Understanding Object-oriented programming with Java*, Updated Edition, Pearson Education, 2000.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 500 GB, 4 GB RAM)	30
2.	Printer	1
3.	Software: JDK, NetBeans IDE / Eclipse IDE or equivalent	30

Course Code	Course Name	L	T	P	C
CS2203	SYSTEM SOFTWARE AND OPERATING SYSTEMS	3	0	0	3

Category: Professional Core Course

a. Preamble

This course enables the students to understand the basic concepts about system software, processes and threads. The students get familiarized with the scheduling algorithms and deadlock handling mechanisms. This course focuses on various memory management schemes and file systems

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Explain different types of system software and its use	K2
CO2	Illustrate the concepts of process, threads and CPU scheduling algorithms	K2
CO3	Explain the algorithms used for concurrency and deadlock handling	K2
CO4	Make use of various memory management schemes	K3
CO5	Demonstrate the concept of file systems.	K2

c. Course Syllabus **Total : 45 Periods**

SYSTEM SOFTWARE **9**

System Software versus Application Software – Basic System Software: Assembler: Two pass assembler, Loader: Absolute and Bootstrap loader, Relocation, Linking, Macro Processor, Text Editor, Debugger, Device Driver, Compiler, and Interpreter.

Operating system objectives and functions - Operating System Structure - System Calls, System Programs, OS Generation and System Boot.

PROCESS MANAGEMENT **9**

Processes - Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling; Threads- Overview, Multithreading models, Threading issues.

PROCESS SYNCHRONIZATION **9**

Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Monitors; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

MEMORY MANAGEMENT **9**

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging; Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing.

STORAGE MANAGEMENT **9**

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management. File-System Interface - File concept, Access methods, Directory Structure, Directory organization; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management; I/O Systems – I/O Hardware, Application I/O interface - Kernel I/O subsystem.

d. Activities

Students shall be exposed to the core concepts of operating systems using case study.

e. Learning Resources

Text Books

1. Leland L Beck, *System Software: An Introduction to Systems Programming*, 3rd Edition, Pearson Education Asia, 1997.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, *Operating System Concepts*, 9th Edition, John Wiley and Sons Inc, 2018.

Reference Books

1. Andrew S Tanenbaum, *Modern Operating Systems*, 2nd Edition, Pearson Education, 2004.
2. Elmasri, R, Carrick, A and Levine, D, *Operating Systems – A Spiral Approach*, Tata McGraw Hill Edition, 2010.
3. Achyut S Godbole and Atul Kahate, *Operating Systems*, McGraw Hill Education, 2016.
4. Gary Nutt, *Operating Systems*, 3rd Edition, Pearson Education, 2004.

5. Harvey M Deitel, *Operating Systems*, 3rd Edition, Pearson Education, 2004.
6. Daniel P Bovet and Marco Cesati, *Understanding the Linux kernel*, 3rd Edition, O'Reilly, 2005.
7. Neil Smyth, *iPhone iOS 4 Development Essentials – Xcode*, 4th Edition, Payload media, 2011.

Course Code	Course Name	L	T	P	C
EC2201	DIGITAL SYSTEM DESIGN AND MICROPROCESSORS	3	1	0	4

Category: Engineering Science Course

a. Preamble

This course promotes students to understand the basic concept of combinational and sequential circuits in digital system design. This course focuses on introducing programmable devices, microprocessors and its applications.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Outline the concepts of Boolean functions and minimization techniques.	K2
CO2	Illustrate the combinational circuits used to perform basic digital operations	K3
CO3	Develop synchronous/asynchronous counters and shift registers using sequential logic.	K3
CO4	Design combinational circuits using programmable logic devices and Memory Devices.	K3
CO5	Explain the 8086 microprocessor and its I/O interfacing concepts	K2

c. Course Syllabus **Total : 60 Periods**

DIGITAL FUNDAMENTALS **12**

Review of Number systems, Logic gates, Boolean algebra - Boolean postulates and laws - Simplification using Boolean algebra, Canonical forms - Sum of product and Product of sum - Minimization using Karnaugh map - NAND and NOR Implementation.

COMBINATIONAL CIRCUITS **12**

Realization of combinational logic using gates , Design of combinational circuits : Adder , Subtractor, Parallel adder / Subtractor, Magnitude Comparator, Code Converters, Parity generator and checker, Encoder, Decoder, Multiplexer, Demultiplexer - Function realization using Multiplexer, Decoder

SYNCHRONOUS SEQUENTIAL CIRCUITS **12**

Latches, Flip-Flops - SR, JK, D & T - Master Slave Flip Flops - Shift Registers - SISO, SIPO, PISO, PIPO, Design of synchronous counters - Modulo N counters, Random Sequence counters, Johnson counter, Ring counter

MEMORY AND PROGRAMMABLE LOGIC DEVICES 12

Random Access Memory - Read Only Memory - Types, Error Detection and Correction, Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Implementation of combinational logic circuits using PLA / PAL, Sequential Programmable Devices

THE 8086 MICROPROCESSOR AND I/O INTERFACING 12

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set – Assembly language programming – I/O Interfacing - Parallel communication interface – Case studies: Traffic Light control, LED display

d. Activities

Students shall be given exposure to understand the combinational and sequential digital circuits and to develop an application by using digital logic.

e. Learning Resources

Text Books

1. Morris Mano, M and Michael D Ciletti, *Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog*, 6th Edition, Pearson Education.and Synthesis, McGraw Hill, 2017.
2. Nagoor Kani, A, *Microprocessors and Microcontrollers*, McGraw Hill, 2017.

Reference Books

1. Charles H.Roth, *Fundamentals of Logic Design*, 6th Edition, Thomson Learning 2013.
2. Mulammad Ali Mazidi and Janice Gillispie Mazidi, *The 80x86 IBM PC and compatible computers - Assembly Language, Design and Interfacing*, 4th Edition, Pearson Education, International Edition, 2003.
3. D. D. Givone, *Digital Principles and Design*, Tata Mc-Graw Hill, New Delhi, 2003.
4. Thomas L Floyd, Digital Fundamentals, 10th Edition, Pearson Education Inc, 2011.
5. Stephen Brown and ZvonkoVranesic, *Fundamentals of Digital Logic with Verilog Design*, 3rd Edition, McGraw-Hill Higher Education, New Delhi, India, 2013.

Course Code	Course Name	L	T	P	C
CS2204	DATA STRUCTURES USING PYTHON LABORATORY	0	0	3	1

Category: Professional Core Courses

a. Preamble

This course enables the students to develop simple applications in Python using stack, queue, linked list, tree, graph, and heap data structures.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Develop programs to perform operations using stack and queues data structures	K3
CO2	Apply the concepts of linked lists to solve a problem	K3
CO3	Apply the appropriate non-linear data structure for solving the problem	K3
CO4	Make use of different searching and sorting algorithms	K3
CO5	Build appropriate hash functions that result in a collision free scenario for data storage and retrieval	K3

c. Course Syllabus **Total : 45 Periods**

1. Implementation of Singly linked list.
2. Applications of List ADT.
3. Array implementation of Stack and Queue ADTs.
4. Linked list implementation of Stack and Queue ADTs.
5. Applications of Stack and Queue ADTs.
6. Implementation of Binary Trees
7. Implementation of Binary Search Trees.
8. Implementation of AVL Trees.
9. Implementation of Heaps.
10. Graph representation, Traversal algorithms.
11. Applications of Graphs.

12. Implementation of searching and sorting algorithms.
13. Implementation of hashing with collision resolution techniques.
14. Mini Project

d. Learning Resources

Text Books

1. Benjamin Baka and David Julian, *Python Data Structures and Algorithms*, Packt Publishers, 2017.
2. Shriram K. Vasudevan, Abhishek S Nagarajan and Karthick Nanmaran, *Data Structures using Python*, Oxford University Press, India, 2021.
3. Rance D Necaise, *Data Structures and Algorithms using Python*, Wiley Student Edition, 2011.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 500 GB, 4 GB RAM)	30
2.	Printer	1
3.	Interpreter: Python	30

Course Code	Course Name	L	T	P	C
EC2202	DIGITAL SYSTEM DESIGN AND MICROPROCESSOR LABORATORY	0	0	4	2

Category: Engineering Science Course

a. Preamble

This course promotes students to design circuits for different digital systems and to interface I/O devices with microprocessors for various applications.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Experiment with the basics of gates	K3
CO2	Build different combinational circuits	K3
CO3	Construct various sequential circuits	K3
CO4	Experiment with 8086 microprocessor based programs	K3
CO5	Build different I/Os with 8086 microprocessor	K3

c. Course Syllabus **Total : 60 Periods**

Digital Experiments

1. Verification of Boolean Theorems using basic gates
2. Design and implementation of combinational circuits using basic gates for arbitrary functions
3. Design and implementation of Half/Full Adder and Subtractor
4. Design and implementation of Encoder, Decoder, Multiplexer and Demultiplexer using logic gates
5. Design and implementation of
   a. BCD to Excess 3 Code Converter & Vice Versa
   b. Binary to Gray Code Converter & Vice Versa
6. Design and implementation of Shift register using Flip flops
7. Design and implementation of 2 bit Synchronous counters

Microprocessor Experiments

8086 Programs using kits and MASM

1. Basic arithmetic and Logical operations
2. Move a data block without overlap

Peripherals and Interfacing Experiments

1. Traffic light control
2. Keyboard and Display Interface

d. Activities

Students shall be given exposure to design a circuit and analyze its performance through hardware components. Based on the gained knowledge, they can do mini projects

e. Learning Resources

Text Books

1. Morris Mano M and Michael D Ciletti, *Digital Design*, 5th Edition, Pearson, 2014.
2. Mulammad Ali Mazidi and Janice Gillispie Mazidi, *The 80x86 IBM PC and compatible computers - Assembly Language, Design and Interfacing*, 4th Edition, Pearson Education, International Edition, 2003.

Reference Books

1. Charles H Roth, *Fundamentals of Logic Design*, 6th Edition, Thomson Learning, 2013.
2. Thomas L Floyd, *Digital Fundamentals*, 10th Edition, Pearson Education Inc, 2011.
3. Salivahanan S and Arivazhagan S, *Digital Electronics*, 1st Edition, Vikas Publishing House pvt Ltd, 2012.
4. Anil K Maini, *Digital Electronics*, Wiley, 2014.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No.	Description of Equipment	Quantity Required
1.	Digital trainer kits	15
2.	Digital ICs	50
3.	8086 Microprocessor trainer kit with power supply	15
4.	Traffic light control interfacing card compatible with 8086	5
5.	Stepper motor control interfacing compatible with 8086 Kits	5
6.	Keyboard & Display interface board compatible with 8086 kits	5

Course Code	Course Name	L	T	P	C
MA2251	DISCRETE MATHEMATICS AND PROBABILITY	3	1	0	4

Category: Foundation Course (Basic Science Courses)

a. Preamble

A course in discrete mathematics represents the discrete structures like predicate logic and proposition. The general counting methods involve permutations and combinations are very useful in constructing computer programs and in mastering many theoretical topics of computer science. The probability theory gives adequate exposure in random variables, probability distributions, regression and correlation.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Use propositional and predicate logic to derive new inference from a given scenario.	K3
CO2	Solve problems using mathematical induction, permutation, combination and recurrence relations.	K3
CO3	Apply graph theory to find shortest path and Euler's circuits in a given network.	K3
CO4	Apply the concepts of probability distributions to solve engineering problems.	K3
CO5	Compute the correlation between two random variables and linear regression equation for a given set of data.	K3

c. Course Syllabus **Total : 60 Periods**

PROPOSITION AND PREDICATE LOGIC **12**

Basic connectives – Truth Table – Tautological Implications – Propositional equivalences – Normal Forms – Rules of inference – Predicates and quantifiers – Nested quantifiers – Universe of discourse – Theory of inference for Predicate calculus.

COMBINATORICS **12**

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations –

Solving linear recurrence relations – Generating functions – principle of Inclusion and exclusion and its applications.

GRAPH THEORY AND ITS APPLICATIONS **12**

Graphs – Matrix representation of graphs – Graph isomorphism – connectivity – Eulerian and Hamiltonian graphs (Proof excluded) – Prim's Algorithm – Kruskal's Algorithm – Problems.

PROBABILITY AND RANDOM VARIABLE **12**

Probability – Conditional probability – Baye's theorem – Random variables – Mathematical Expectations – Moments – Moment generating functions – Distributions: Binomial, Poisson, Geometric, Uniform, Exponential and Normal distribution.

TWO DIMENSIONAL RANDOM VARIABLES **12**

Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and linear regression – Central limit theorem (proof excluded) – Transformation of Random Variables

d. Activities

Solving discrete and continuous distribution problems using Electronic Spread Sheet.

e. Learning Resources

Text Books

1. Rosen, K H, *Discrete Mathematics and its Applications*, Tata McGraw Hill, 7th Edition, New Delhi, 2015.
2. Johnson, R A, Miller, I and Freund J, *Miller and Freund's Probability and Statistics for Engineers*, Pearson Education, 8th Edition, Asia, 2015.

Reference Books

1. Grimaldi, R P, *Discrete and Combinatorial Mathematics: An Applied Introduction*, Pearson Education Asia, 5th Edition, Delhi, 2019.
2. Lipschutz, S and Mark Lipson, *Discrete Mathematics*, Tata McGraw Hill, 3rd Edition, New Delhi, 2010.
3. Kenneth H Rosen, *Discrete Mathematics with Applications*, Tata McGraw Hill, 8th Edition, 2021.
4. Ross, S M, *Introduction to Probability and Statistics for Engineers and Scientists*, Elsevier, 5th Edition, 2014.
5. Spiegel, M R, Schiller, J and Srinivasan, R A, *Schaum's Outline of Theory and Problems of Probability and Statistics*", Tata Mc Graw Hill, 4th Edition, 2012.

Course Code	Course Name	L	T	P	C
CS2251	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

Category: Professional Core Course

a. Preamble

This course enables the students to learn the fundamentals of data models and to represent a database system using ER diagrams and study SQL and relational database design. This course enriches the knowledge in the internal storage structures using different file and indexing techniques which will help in physical database design. This course enables the students to understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures and learn about file organization and query processing

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Infer the basic concepts of database system and model ER diagram for real time applications	K3
CO2	Use appropriate SQL commands to store and access data from Relational Database.	K3
CO3	Construct normalized database for real world scenario using functional dependencies	K3
CO4	Illustrate the importance of concurrency control in transaction to maintain consistency in a database	K3
CO5	Interpret the mechanisms incorporated in file organization and Query	K3

c. Course Syllabus **Total : 45 Periods**

INTRODUCTION TO DATABASE & ER MODEL **9**

Introduction to Databases - File System Vs Database System - Database System Architecture- Database Users and Administrator - Data Models - Entity Relationship Model - E-R Diagrams - Design Issues - Extended E-R Features - Introduction to Relational Model - ER to Relational Schema Mapping.

RELATIONAL MODEL & SQL **9**

Structure of Relational Databases - Relational Query Languages - Relational Algebra – SQL: DDL, DML, DCL, TCL - Simple Queries, Complex Nested Queries, Correlated Nested Queries, Joins, Aggregate Functions, Grouping - PL/SQL : Functions, Procedures, Triggers, Views -Embedded SQL - Dynamic SQL.

NORMALIZATION **9**

Pitfalls in Bad Relational database design - Functional Dependencies (Closure of Functional dependencies) - Closure of Attributes - Normal Forms : First, Second, Third, Boyce Codd Normal Form, Multivalued Dependencies : Fourth Normal Form, Join Dependencies : Fifth Normal Form –Domain Key Normal Form.

TRANSACTION AND CONCURRENCY CONTROL **9**

Transaction processing concepts - Need for concurrency control and recovery - Recoverability – Transaction Recovery – Serializability : Conflict Serializability, View Serializability, Testing for Serializability - Concurrency Control : Lock Based Protocols (Two phase locking Techniques, Strict Two Phase Locking, Deadlocks, Multiple Granularity) Timestamp Based protocol, Validation Based protocol.

FILE ORGANIZATION & QUERY PROCESSING **9**

File Organization: Organization of Records in Files, Indexing and Hashing, Ordered Indices - Query Processing: Measures of Query Cost (Selection, Sorting and Join Operation), Query Tuning, Query Optimization (Transformation of Relational Expressions, Choice of Evaluation Plans, Materialized Views) – No SQL – Mongo DB.

d. Activities

Students shall be involved in various activities to improve conceptual learning:

i. Chart preparation

ii. Quiz

e. Learning Resources

Text Books

1. Abraham Silberschatz, Henry F. Korth, S and Sudharshan, *Database System Concepts*, 6th Edition, Tata McGraw Hill. 2017.
2. Ramez Elmasri and Shamkant B Navathe, *Fundamentals of Database Systems*, 6th Edition, Pearson Education, 2011.

Reference Books

1. Date C J, Kannan A, and Swamynathan S, *An Introduction to Database Systems*, 8th Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, *Database Management Systems*, 4th Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta, *Database Management Systems*, Tata McGraw Hill, 2011.

Course Code	Course Name	L	T	P	C
CS2252	DESIGN AND ANALYSIS OF ALGORITHMS	3	0	0	3

Category: Professional Core Course

a. Preamble

This course enables the students to apply the knowledge of computing and mathematics to algorithmic design. This course enriches the logical skills of the students by solving the real world problems.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Compute the time and space complexity of Algorithms.	K3
CO2	Apply Bruteforce and Divide & Conquer techniques for sorting and searching Problems.	K3
CO3	Apply Greedy and Dynamic Programming techniques for Graph and Combinatorial Problems.	K3
CO4	Apply Iterative improvement techniques to solve optimization problems.	K3
CO5	Apply Backtracking, Branch & Bound and approximation techniques for NP-Complete and NP-Hard Problems.	K3

c. Course Syllabus **Total : 45 Periods**

INTRODUCTION **9**

Notion of an Algorithm - Fundamentals of Algorithmic Problem Solving - Important Problem Types - Performance analysis - space and time complexity - Growth of function – Big-Oh, Omega, theta notation - Asymptotic Notations and its properties-Recurrent equations and the master theorem - Mathematical analysis for Recursive and Non-recursive algorithms.

BRUTE FORCE AND DIVIDE-AND-CONQUER **9**

Brute Force – String Matching - Closest-Pair and Convex-Hull Problems-Exhaustive Search - Traveling Salesman-Problem - Knapsack Problem - Assignment problem-Divide and conquer methodology – Merge sort – Quick sort – Heap Sort - Binary search – Strassen’s matrix multiplication.

GREEDY TECHNIQUE AND DYNAMIC PROGRAMMING **9**

Greedy Technique– Container loading problem Minimum cost spanning tree Prim's algorithm- Kruskal's Algorithm-Dijkstra's Algorithm- Job sequencing with deadlines - Huffman Trees - Dynamic programming – Principle of optimality –Computing a Binomial Coefficient – Warshall's and Floyd' algorithm – Optimal Binary Search Trees – 0/1 Knapsack Problem and Memory functions.

ITERATIVE IMPROVEMENT **9**

The Simplex Method-The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs- The Stable Marriage Problem.

COPING WITH THE LIMITATIONS OF ALGORITHM POWER **9**

Lower-Bound Arguments-Decision Trees-P, NP and NP-Complete Problems-Coping with the Limitations - Backtracking – n-Queens problem – Subset Sum Problem – Branch and Bound – Assignment problem – Knapsack Problem – Approximation Algorithms for NP – Hard Problems – Traveling Salesman problem - Twice around the tree algorithm.

d. Activities

Students shall be exposed to solve simple problems using different algorithm design techniques.

e. Learning Resources

Text Books

1. Anany Levitin, *Introduction to the Design and Analysis of Algorithms*, 3rd Edition, Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, *Computer Algorithms/ C++*, 2nd Edition, Universities Press, 2007.

Reference Books

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, *Introduction to Algorithms*, 3rd Edition, PHI Learning Private Limited, 2012.
2. Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, *Data Structures and Algorithms*, Pearson Education, Reprint, 2006.

Course Code	Course Name	L	T	P	C
CS2253	SOFTWARE ENGINEERING WITH UML DESIGN	3	0	0	3

Category: Foundation Course (Engineering Science)

a. Preamble

This course enables the students to understand the importance of the fundamental concepts of software process and requirements engineering. This course explores UML static modeling and dynamic modeling. This course focuses on various management concepts and the different testing strategies

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Develop life cycle models for software development	K3
CO2	Model the static features of a system.	K3
CO3	Model the dynamic features of a system.	K3
CO4	Illustrate the different management techniques.	K2
CO5	Demonstrate the various testing methodologies.	K2

c. Course Syllabus **Total : 45 Periods**

SOFTWARE PROCESS AND REQUIRMENTS ENGINEERING 9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming - XP Process - Functional and non-functional requirements- The software requirements document- Requirements specification- Requirements engineering processes- Requirements elicitation and analysis- Requirements validation- Requirements management.

STATIC MODELING 9

Use case Modeling - Relating Use cases – include, extend and generalization - Elaboration - Domain Models - Finding conceptual classes and description classes - Associations – Attributes – Domain model refinement – Finding conceptual class hierarchies - Aggregation and Composition - UML activity diagrams and modeling.

DYNAMIC MODELING AND IMPLEMENTATION **9**

System sequence diagrams – Logical architecture and UML package diagram – Logical architecture refinement - UML class diagrams – relationship – inheritance – Abstract classes –Operation contracts - Mapping design to code – Test driven development – Refactoring – UML tools and UML as blueprint - UML state machine diagrams and modeling - Designing for visibility - Adopting Agile modeling on an UP project.

DESIGN AND MANAGEMENT CONCEPTS **9**

Design Process-Design Concepts-Design Model-Software Configuration Management-The SCM Repository-The SCM process – Project Management Concepts: The management Spectrum-People-The Product-The process- The Project-Project Scheduling-Risk Management

SOFTWARE TESTING STRATEGIES **9**

Test Strategies for Conventional Software-Validation Testing-System Testing- Testing Conventional Applications: White-Box Testing - Basis Path Testing-Control Structure Testing - Black box testing: Equivalence Partitioning-Boundary Value Analysis.

d. Activities

Students shall be depicted the fundamental concepts of Software Engineering process and to demonstrate various testing strategies

e. Learning Resources

Text Books

1. Roger S Pressman, *Software Engineering: A practitioner's Approach*, 9th Edition, McGraw-Hill International Edition, 2019.
2. Craig Larman, *Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design*, 3rd Edition, Pearson Publishers, 2015.

Reference Books

1. Bhuvan Unhelkar, *Software Engineering with UML*, 1st Edition, Auerbach Publications, 2018.
2. Martina Seidl, Marion Scholz, Christian Huemer and Gerti Kappel, *UML @ Classroom: An Introduction to Object-Oriented Modeling*, Springer Verlag, 2015.

Course Code	Course Name	L	T	P	C
AI2201	ARTIFICIAL INTELLIGENCE	3	0	0	3

Category: Professional Core Course

a. Preamble

This course enables the students to understand the various characteristics of Intelligent agents and different search strategies. This course familiar with represent knowledge in solving Artificial Intelligence problems and agent communication. This course emphasis on various applications of Artificial Intelligence

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Explain the various characteristics of intelligent agents.	K2
CO2	Interpret appropriate search algorithms for Artificial Intelligence problem.	K2
CO3	Illustrate a Knowledge Representation using first order logic.	K2
CO4	Infer different ways of the agent communication and Trust and Reputation in Multi-agent systems.	K2
CO5	Summarize the applications of AI.	K2

c. Course Syllabus **Total : 45 Periods**

INTRODUCTION **9**

Introduction–Definition - The Foundations of Artificial Intelligence- Characteristics of Intelligent Agents -Turing test – Agents and Environments - Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents; Problem Solving Approach to Typical AI problems

PROBLEM SOLVING USING SEARCHING **9**

Problem-Solving Agents, Formulating problems, searching for Solutions, Uninformed Search Strategies, Breadth-first search, Depth-first search, searching with Partial Information, Informed Search Strategies, Greedy best-first search, A* Search-IDA*-Heuristic Functions, Local Search Algorithms and Optimization Problems - Constraint

Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning

LOGIC AND INFERENCES **9**

Propositional Logic - First Order Logic – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories.

AGENT COMMUNICATION **9**

Architecture for Intelligent Agents – Agent communication - Agents and Objects – Negotiation and Bargaining –Argumentation among Agents – Trust and Reputation in Multi-agent systems.

APPLICATIONS **9**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

d. Activities

Students shall be exposed to basic Artificial Intelligence concepts and applications.

e. Learning Resources

Text Book

1. Russell, S and Norvig, P, *Artificial Intelligence: A Modern Approach*, 4th Edition, Prentice Hall, 2020.

Reference Books

1. Elaine Rich and Kevin Knight, *Artificial Intelligence*, 3rd Edition, Tata McGraw-Hill, 2008.
2. Tim Jones, M, *Artificial Intelligence: A Systems Approach (Computer Science)*, 1st Edition Jones and Bartlett Publishers, Inc, 2008.
3. Nils J Nilsson, *The Quest for Artificial Intelligence*, Cambridge University Press, 2009.
4. Gerhard Weiss, *Multi Agent Systems*, 2nd Edition, MIT Press, 2013.
5. David L Poole and Alan K Mackworth, *Artificial Intelligence: Foundations of Computational Agents*, Cambridge University Press, 2010.

Course Code	Course Name	L	T	P	C
GE2201	DESIGN THINKING	3	0	0	3

Category: Foundation Course (Engineering Science)

a. Preamble

This course introduces the various principles of design thinking to achieve an effective design and to examine the implementation of the model or process for its successful operation.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Describe the basic principles of design and various stages of design thinking for better conceiving of idea and refinement	K2
CO2	Elucidate the concepts of idea generation and refinement	K3
CO3	Apply various prototype models for solving complex problems	K3
CO4	Analyze real-time problems for effective design, implementation and operation	K3
CO5	Device idea/solution towards development of a prototype for a chosen problem of interest	K4

c. Course Syllabus **Total : 45 Periods**

INTRODUCTION TO DESIGN THINKING **9**

Introduction - Product life cycle – Design Ethics – Design Process – Stages in design thinking: Immersion, Analysis and synthesis, Ideation, Prototyping.

IDEA GENERATION AND REFINEMENT **9**

Basic design - directions - Themes of thinking - Inspiration and references – Brainstorming - Value - Inclusion – Sketching - Presenting ideas - Thinking in images - Thinking in signs - Appropriation - Personification - Visual metaphors - Modification - Thinking in words - Words and language - Thinking in shapes - Thinking in proportions - Thinking in color - Outside the Box.

PROTOTYPING **9**

Developing designs - Types of prototype - Prototyping for Designing Complex Systems - The Efficacy of Prototyping under Time Constraints.

IMPLEMENTATION **9**

Format - Materials - Finishing - Media - Scale - Series/Continuity - Emerging Landscapes of Design - Real-Time Design Interaction Capture and Analysis - Enabling Efficient Collaboration in Digital Design - Spaces Across Time and Distance - Software used in Developing in Virtual Environments.

DESIGN THINKING IN VARIOUS SECTORS **9**

Design & Development of Prototypes for Wall Plastering, Rubber shredding, Separation of Corn seeds, Electric vehicles, Smart gates, Burglar alarm, Tyre pressure monitor, Development of Online Voting System, Online Proctoring System, Online Health Monitoring System, IoT based Home Automation and any other problem of interest in your domain.

d. Activities

Students shall be exposed to design thinking concepts and to design simple prototypes related to various sectors.

e. Learning Resources

Text Books

1. Binder, T, De Michelis, G, Ehn, P, Jacucci, G, Linde, P and Wagner, I., *Design Things*, MIT press, 2011.
2. Ambrose, G and Harris, P, *Basics Design: Design thinking*, Bloomsbury Publishing, 2009.

Reference Books

1. Meinel, C and Leifer, L. (Eds.)., *Understanding Innovation*, Springer, 2011.
2. Plattner, H, Meinel, C, and Leifer, L. (Eds.)., *Design thinking: understand – improve–apply*, Springer Science & Business Media, 2010.
3. Moran, T. P and Carroll, J. M, *Design Rationale: Concepts, Techniques, and Use*, L. Erlbaum Associates Inc, 1996.
4. Cross, N, *Developments in Design Methodology*, Chichester: Wiley, 1984.

WEB RESOURCES

1. https://www.designsociety.org/download-publication/39626/Design+prototyping+of+systems
2. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process

VIDEO LECTURES :(NPTEL OR ANY OTHER VIDEO LECTURES)

https://nptel.ac.in/courses/110/106/110106124/#

Course Code	Course Name	L	T	P	C
GE2251	QUANTITATIVE APTITUDE	1	0	0	1

Category: Employability Enhancement Course

a. Preamble

To develop the thinking ability and problem solving skills of students to compete themselves in placement and competitive examinations.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Apply the concept of profit in real life problems	K3
CO2	Solve the problems by using proportion	K3
CO3	Compute accurate speed, time and distance	K3
CO4	Apply the concept of Time & Speed	K3
CO5	Calculate the work done based on various methods	K3

c. Course Syllabus **Total : 15 Periods**

PROFIT AND LOSS **3**

Profit and Loss - Cost Price, Selling Price, Profit and Loss %, Marked Price, Discount.

RATIO AND PROPORTION **3**

Ratio and Proportion - Ratio, Proportion, Comparison of Ratios, Duplicate, Triplcate Ratio.

TIME, SPEED AND DISTANCE **3**

Time, Speed and Distance - Concept of time, speed and distance, Conversion of units and proportionality, Avearge speed concept.

APPLICATIONS ON TIME, SPEED AND DISTANCE **3**

Problems on trains - Relative speed concept and application. Boats and Streams - Upstream speed, Downstream speed, Speed of stream, Speed of boat.

TIME AND WORK **3**

Time & work - Problems based on time and work, Formulae, Computation of work together, Wages based work problems. Pipes & Cisterns - Inlet-outlet, Part of tank filled, Time based problems.

d. Learning Resources

Text Book

1. Dinesh Khattar, *Quantitative Aptitude for Competitive Examinations*, Pearson India Education services Pvt Ltd, 4th Edition, Uttar Pradesh, 2019.

Reference Books

1. TCY online, *Reasoning ability and Quantitative Aptitude*, Wiley India Pvt. Ltd, 1st Edition, New Delhi, 2016.
2. Agarwal R S, *Quantitative Aptitude for Competitive Examinations*, S.Chand Limited, 2011.
3. Abhijit Guha, *Quantitative Aptitude for Competitive Examinations*, Tata McGraw Hill, 3rd Edition, 2011.

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Course Code	Course Name	L	T	P	C
CS2254	DATABASE MANAGEMENT SYSTEMS LABORATORY	0	0	4	2

Category: Professional Core Course

a. Preamble

This course enables the students to learn the commands for creating and manipulating the databases. This course makes students to construct queries for retrieval of required data from database and understand views, sequences and synonyms concepts of SQL. This course enriches the knowledge in the concepts of the functions, procedures, triggers and exception handling in SQL. This course enables the students to develop GUI based application for storage and retrieval of data.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Choose appropriate DDL, DML, DCL and TCL commands for creating and manipulating the databases.	K3
CO2	Construct appropriate nested queries, sub queries and join queries for efficient retrieval of data.	K3
CO3	Organize database using views, sequences, and synonyms..	K3
CO4	Implement functions, procedures, triggers and exceptions using PL/SQL.	K3
CO5	Develop a GUI based environment for storage and retrieval of data for a real time application.	K3

Total : 60 Periods

c. Course Syllabus

1. **WRITE AND EXECUTE SIMPLE QUERIES USING SQL**
    a. DDL, TCL and DCL commands
    b. DML commands
    c. Aggregate Functions
2. **WRITE AND EXECUTE ADVANCED QUERIES USING SQL**
    a. Nested Queries and Sub queries

b. SQL Join

3. **WRITE AND EXECUTE VIEWS, SYNONYMS, SEQUENCE**
4. **WRITE AND EXECUTE QUERIES USING PL/SQL**
    a. Simple programs
5. **WRITE AND EXECUTE QUERIES USING ADVANCED CONCEPTS OF PL/SQL**
    a. Cursors and Procedures
    b. Functions
    c. Triggers
    d. Exception Handling
6. **IMPLEMENT DATABASE CONNECTIVITY CONCEPTS**
    a. Design a Front End for a real time application
    b. Connect the database with the application
7. **MINI PROJECT**

e. Learning Resources

Reference Books

1. Abraham Silberschatz, Henry F Korth and Sudharshan S, Database System Concepts, 6th Edition, Tata McGraw Hill. 2017.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 6th Edition, Pearson Education, 2011.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 500 GB, 4 GB RAM)	30
2.	Printer	1
3.	Software: MySQL, Netbeans IDE / XAMPP	30

Course Code	Course Name	L	T	P	C
CS2255	MOBILE APPLICATION DEVELOPMENT LABORATORY	0	0	4	2

Category: Professional Core Course

a. Preamble

The course has been designed to impart practical knowledge on Android application programming thus to reduce the gap between the demand and supply of Competent Android Application Developers. This course enables the students to develop mobile application to satisfy the basic needs in our daily life activities and also the applications which are needed for businesses, industries and educational institutions.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Develop an application using GUI Components, Layout Managers and Event Listeners	K3
CO2	Develop an application that makes use of database	K3
CO3	Apply the concepts of Multithreading and RSS Feed for application development	K3
CO4	Implement an application that writes data to SD card	K3
CO5	Develop a native application that uses GPS location Information and E-mail service	K3

c. Course Syllabus **Total : 60 Periods**

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager
6. Implement an application that uses Multi-threading
7. Develop a native application that uses GPS location information
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message

10. Write a mobile application that makes use of RSS feed.
11. Develop a mobile application to send an email.
12. Develop a Mobile application for simple needs (Mini Project)

d. Learning Resources

Reference Book

1. Wei-Meng-Lee, *Beginning Android Application Development*, Wiley Publishing Inc. 2011.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No.	Description of Equipment	Quantity Required
1.	Hardware Requirements Personal Computers (Intel Core i3, 500 GB, 8 GB RAM)	30
2.	Printer	1
3.	Software Tools: Android Studio, Android Emulator	30

Course Code	Course Name	L	T	P	C
EM2252	AN INTRODUCTION TO ADVANCED READING AND WRITING	0	0	2	1

Category: Employability Enhancement Course

a. Preamble

The course will enable learners to

- Strengthen the reading skills of students of engineering.
- Enhance their writing skills with specific reference to technical writing
- Develop their critical thinking skills.
- Provide more opportunities to develop their project and proposal writing skills

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Understand how the text positions the reader	K3
CO2	Develop critical thinking while reading a text	K3
CO3	Develop a descriptive paragraph	K3
CO4	Make use of sentence structures effectively when creating an essay.	K3
CO5	Demonstrate proper usage of grammar in writing E-Mails, Job application and project	K3

c. Course Syllabus **Total : 30 Periods**

EFFECTIVE READING **6**

Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title. Reading-Read for details-Use of graphic organizers to review and aid comprehension.

CRITICAL READING **6**

Reading– Understanding pronoun reference and use of connectors in a passage- speed reading techniques. Reading– Genre and Organization of Ideas- Reading– Critical reading and thinking- understanding how the text positions the reader

PARAGRAPH WRITING **6**

Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence.-Write a descriptive paragraph Writing-State reasons and examples to support ideas in writing– Write a paragraph with reasons and examples- Write an opinion paragraph

ESSAY WRITING **6**

Writing– Elements of a good essay - Types of essays- descriptive-narrative- issue-based-argumentative-analytical

EFFECTIVE WRITING **6**

Writing– Email writing- visumes – Job application- Report Writing - Project writing- Writing convincing proposals

d. Activities

Students shall be exposed to various passages for reading and trained to write in different forms.

e. Learning Resources

Text Books

1. Gramer, F Margot and Colin, S Ward, *Reading and Writing (Level 3)* Oxford University Press, Oxford, 2011.
2. Debra Daise, CharlNorloff and Paul Carne, *Reading and Writing (Level 4)* Oxford University Press: Oxford, 2011.

Reference Books

1. Davis, Jason and Rhonda Liss, *Effective Academic Writing (Level 3)* Oxford University Press: Oxford, 2006.
2. Suresh Kumar E, *Enriching Speaking and Writing Skills*, 2nd Edition, Orient Black swan: Hyderabad, 2012.
3. Withrow and Jeans, *Inspired to Write. Readings and Tasks to develop writing skills*, Cambridge University Press: Cambridge, 2004.
4. Goatly, Andrew, *Critical Reading and Writing*, Routledge: United States of America, 2000.
5. Petelin, Roslyn and Marsh Durham, *The Professional Writing Guide: Knowing Well and Knowing Why*, Business & Professional Publishing: Australia, 2004.