



B. M. S. COLLEGE OF ENGINEERING BENGALURU-19

(Autonomous College under VTU)

SCHEME OF INSTRUCTION (w.e.f. 2020-21)

Department: Computer Applications

Semester: I

Sl. No.	Course Code	Course Title	Credits				Contact Hrs./Wk.	Marks		
			L	T	P	Total		CIE	SEE	Total
1.	20MCA1PCPY	Python Programming	3	0	2	5	7	40	60	100
2.	20MCA1PCUS	Unix and Shell Programming	0	0	2	2	4	40	60	100
3.	20MCA1PCWT	Web Technologies	3	0	2	5	7	40	60	100
4.	20MCA1BSMS	Mathematics and Statistical Foundations	3	1	0	4	5	40	60	100
5.	20MCA1PCSE	Software Engineering	2	1	0	3	4	40	60	100
6.	20MCA1PCCN	Computer Networks	3	1	0	4	5	40	60	100
7.	20MCA1HSPE	Professional Communication and Ethics	1	1	0	2	3	40	60	100
8.	20MCA1NCA1*	MOOC Course	0	0	0	0	-	-	-	-
9.	20MCA1NCBC**	Problem Solving and C Programming	0	0	0	0	5**	40**	-	-
Total			15	4	6	25	35	280	420	700

Abbreviations used:

L:	Lecture	HS:	Humanities, Social Science, Management
T:	Tutorial	PW:	Project
P:	Practical	SR:	Seminar
CIE:	Continuous Internal Evaluation	NT:	Internship
SEE:	Semester End Examination	NC:	Non-Credit
PC:	Program Core	BS:	Basic Science
PE:	Program Elective		

* 20MCA1NCA1 - Design thinking/a similar course; **20MCA1NCBC - Bridge Course only for Non-Computer science students (LTP: 1-0-2)



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Department: Computer Applications

Semester: II

Sl. No.	Course Code	Course Title	Credits				Contact Hrs./Wk.	Marks		
			L	T	P	Total		CIE	SEE	Total
1.	20MCA2PCDS	Data Structures and Algorithms	3	0	1	4	5	40	60	100
2.	20MCA2PCML	Machine Learning	3	0	1	4	5	40	60	100
3.	20MCA2PCJP	Java Programming	3	0	1	4	5	40	60	100
4.	20MCA2PCDB	Database Management Systems	2	1	0	3	4	40	60	100
5.	20MCA2PCCC	Cloud Computing	2	0	1	3	4	40	60	100
6.	Elective-I									
	20MCA2PEAI	Artificial Intelligence and Deep Learning	3	0	0	3	3	40	60	100
	20MCA2PECS	Cyber Security								
	20MCA2PEUI	User Interface and User Experience								
	20MCA2PERR	R Programming								
7.	Elective-II									
	20MCA2PEBD	Big Data and NoSQL	3	1	0	4	5	40	60	100
	20MCA2PEWS	Wireless and Sensor Networks								
	20MCA2PEAD	Agile Methodologies and Devops								
	20MCA2PEAW	Advanced Web Programming								
8.	20MCA2NCA2*	Extra/Co-curricular Activities	0	0	0	0	-	-	-	-
Total			19	2	4	25	31	280	420	700

*20MCA2NCA2 - Participation in Inter-Collegiate Competitions – Hackathons, Extra/Co-curricular Activities, etc.



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Semester: III

Sl. No.	Course Code	Course Title	Credits				Contact Hrs./Week.	Marks		
			L	T	P	Total		CIE	SEE	Total
1.	20MCA3HSSM	Software Project Management	2	1	0	3	4	40	60	100
2.	20MCA3PCIT	Internet of Things	2	0	2	4	6	40	60	100
3.	20MCA3PCMA	Mobile Application Development	2	0	2	4	6	40	60	100
4.	20MCA3PWMI	Mini Project	0	0	3	3	6	40	60	100
5.	Elective III									
	20MCA3PESC	Soft Computing	3	0	1	4	5	40	60	100
	20MCA3PEFC	Fog and Edge Computing								
	20MCA3PEST	Software Testing and Practice								
	20MCA3PENT	.Net programming								
6.	Elective IV									
	20MCA3PEAV	Augmented Reality and Virtual Reality	3	0	1	4	5	40	60	100
	20MCA3PESN	Social Network Analysis								
	20MCA3PEBC	Block chain Technologies								
	20MCA3PEAJ	Advanced Java Programming								
7.	20MCA3HSES	Entrepreneurship and IPR	2	1	0	3	4	40	60	100
8.	20MCA3NCA3*	Societal Activity	0	0	0	0	-	-	-	-
Total			14	2	9	25	36	280	420	700

*20MCA3NCA3 - Societal/Health/Environmental awareness, etc. work at an NGO or any other institution

**B. M. S. COLLEGE OF ENGINEERING BENGALURU-19**

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Department: Computer Applications**Semester:** IV

Sl. No.	Subject Code	Course Title	Credits	Marks		
			Total	CIE	SEE	Total
1.	20MCA4PWMP	Major Project	19	100	100	200
2.	20MCA4NTIP**	Internship	4	40	60	100
3.	20MCA4SRSR	Seminar (Research Oriented)	2	40	60	100
4.	20MCA4NCA4*	Personality Development	0	-	-	-
	TOTAL		25	180	220	400

* 20MCA4NCA4 - Stress/Time Management, Balancing Personal/Professional life, Leading Happy and Purposeful Life, Inter-Personal Skills, etc.

** Internship shall be carried out for 6 weeks during summer break after II semester.



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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER –I

COURSE TITLE	PYTHON PROGRAMMING	Credits	5
COURSE CODE	20MCA1PCPY	L-T-P	3-0-2
CIE	40	SEE	60

Prerequisites: Fundamentals of Programming Languages.

UNIT 1:

Fundamentals of Python Programming: Data types in Python, Operators in Python, Input and Output Statements, Control Statements.

Arrays: Creating, Processing Array Elements and handling Array Operations.

Strings Characters: Creating, Indexing, Slicing, Repeating and Concatenation, Comparing, removing spaces, Finding sub strings in String.

Functions: Defining, Calling Returning results from a function. Pass by Object Reference, Formal, Actual, Positional, Keyword, Default, Variable Length Arguments. Local and Global Variables.

(8 Hours)

UNIT 2:

Lists: Creating List using range () function, Updating the elements of a list, Concatenation of two list, Repetition of lists, Membership in lists, Aliasing and Cloning lists, Sorting list elements, Nested lists.

Tuples: Creating and Accessing Tuple Elements, Basic Operation on Tuples, Nested Tuples, Inserting, Modifying and Deleting Elements of a Tuple.

Dictionaries: Operation on Dictionaries, Dictionary Methods, Sorting Elements of a Dictionary, Converting Lists in to Dictionary.

(7 Hours)

UNIT 3:

Classes and Objects: Creating Class, The Self Variable, Constructor, Types of Variables, Namespaces, Types of Methods, Passing members between classes, Inner Classes.

Inheritance and Polymorphism: Constructor in Inheritance, Overriding Super Class Constructors and Methods, The super () Method, Types of Inheritance,

Method Resolution Order(MRO), Polymorphism, Duck Typing Philosophy of Python, Operator and Method Overloading and Method Overriding.

Abstract Classes and Interfaces: Abstract Methods and Class, Interfaces in Python, Abstract Classes vs. Interfaces. **(7 Hours)**

UNIT 4:

Introduction to Data Science using Python: Creation of Data Frame from Excel spreadsheet, CSV files, Dictionary and Tuples, Operation of data frames.

Data Visualization: Creation of Bar graph, Histogram, Pie chart, Line Graph.

(7 Hours)

UNIT 5:

Graphical User Interface development and Database in Python: GUI in Python, the Root Window, Font and colors, working with Containers, Canvas, Frames. Widgets.

Fundamental concepts of database, installing MySQL, Using MySQL from Python, Retrieving All Rows from a table, Inserting Rows in a Table, Updating Rows in a Table, Deleting Rows in a Table, Creating Database Tables through python. **(7 Hours)**

Text Books:

Sl. No.	Content
1.	R Nageswara Rao, "Core Python Programming", Dreamtech Press, 2018 Edition.

Reference Books:

Sl. No.	Content
1.	Mark Lutz, "Programming Python", 4 th Edition, O'Reilly Media.
2.	Timothy A. Budd, "Exploring Python", , McGraw Hill Education, 2 nd Reprint 2015
3.	Paul Gries, Jennifer Campbell, Jason Montojo, "Practical Programming: An Introduction to Computer Science Using Python 3" (Pragmatic Programmers) Second Edition
4.	E Balaguruswamy, "Introduction to Computing and Problem Solving Using Python", McGraw Hill Education.
5.	Mark Summerfield, "Programming in Python 3: A Complete

	Introduction to the Python Language", 2nd Edition, Addison-Wesley Professional
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E- Books:

Sl. No.	Content
1.	Python for Everybody, http://py4e.com/book.php
2.	Python Cookbook http://chimera.labs.oreilly.com/books/12300000000393
3.	Functional Programming in Python http://www.oreilly.com/programming/free/functional-programming-python.csp

Online Courses and Video Lectures:

Sl. No.	Content
1.	The Joy Of Computing using Python, https://nptel.ac.in/courses/106/106/106106182/
2.	Python for Everybody Specialization, https://www.coursera.org/specializations/python

List of Lab programs integrated with Python programming theory:

Programs to demonstrate the usage of:

01. Data types and Operators
02. Arrays and List
03. Dictionaries and Tuples
04. Function
05. Class and Objects
06. Inheritance
07. Polymorphism
08. Abstract Class and Interface
09. Dataframes
10. Canvas
11. Frames
12. Databases

To be considered for Alternative Assessment

Build an application using Python, which includes the following features:

1. User and navigation friendly interfaces.
2. Database connectivity and handling data store.

Course Outcomes:

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

CO1	Demonstrate the programming concepts of python.	-----
CO2	Apply the python programming concepts to solve a problem	PO1(2)
CO3	Analyse the problem and obtain a solution	PO2(2)
CO4	Build an application with graphical user interfaces and database	PO5(3) PO7(1)



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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER – I

COURSE TITLE	UNIX AND SHELL PROGRAMMING	Credits	2
COURSE CODE	20MCA1PCUS	L-T-P	0-0-2
CIE	40	SEE	60

Prerequisites: None

1. Exploring with UNIX basic commands.
2. Understanding UNIX file system and practising commands on navigation of file system, commands on ordinary files: cat, cp, rm, mv, more, lp, file
3. Practising with commands: wc, od, split, cmp, comm, diff
4. Exploring basic file attributes using ls, file permissions, file ownerships, chmod
5. Creating shell scripts, command line arguments, exit, exit status, Use of logical operators and conditional execution (if conditional, test, [], case conditional)
6. Computation and string handling (expr), while, for, set and shift
7. Understanding process basics, ps: process status, system processes (-e or -a), running jobs in background, nice, kill, at and batch, cron, time, inode, hard and symbolic link, umask, find
8. Simple filters: pr, head, tail, cut, paste, sort, uniq, grep, sed, egrep, fgrep
9. awk filtering, splitting a line into fields, printf, variables and expressions, the comparison operator, number processing, variables, the -f option, the Begin and End sections, built-in variables
10. awk programming using arrays, functions
11. awk programming using for, while loops.

Text Books:

Sl. No.	Content
1.	Sumitabha Das, UNIX Concepts and Applications, 4th Edition, Tata McGraw Hill , 2006.

Reference Books:

Sl. No.	Content
1.	Stephen G. Kochan, Shell Programming in Unix, Linux and OS X, Fourth edition, Pearson Education, 2017.
2.	Yashavant P Kanetkar, Unix Shell Programming, BPB Publications, 2003.

E- Books and Online Course Materials:

Sl. No.	Content
1.	Stanimira Vlaeva, Practical Introduction to the command line, Coursera https://www.coursera.org/projects/practical-introduction-to-the-command-line
2.	Sean Kross, The UNIX workbench, Coursera https://www.coursera.org/learn/unix
3.	Behrouz A Forouzan, Unix and Shell Programming: A Textbook by Behrouz A. Forouzan https://www.pdf-book-search.com/and/unix-and-shell-programming-a-textbook-by-behrouz-a-forouzan.html

Course Outcomes:

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

CO1	Apply the concepts of Unix to solve computing problems.	PO1 (3)
CO2	Implement programs using Unix shell programming concepts for a given problem.	PO5 (3)



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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER – I

COURSE TITLE	WEB TECHNOLOGIES	Credits	5
COURSE CODE	20MCA1PCWT	L-T-P	3-0-2
CIE	40	SEE	60

UNIT 1:

Web programming fundamentals

Origin and Evolution of HTML and XHTML: Syntax, elements, attributes, headings, paragraph, style, formatting, tables, links, images and lists. HTML5 elements: media, audio and video, forms.

Cascading Style Sheets: Syntax, selectors, colors, background, text, fonts, icons, links, box model, span and div, conflict resolution

(7 Hours)

UNIT 2:

Introduction to Bootstrap

Introduction to Bootstrap: Getting started, grid basics, typography, colors, tables, jumbotron, button, progress bar, alerts, tooltip, icons, nav, navbars.

(7 Hours)

UNIT 3:

Scripting Language and frameworks

Overview of JavaScript, Syntactic Characteristics, Primitives, Operations and Expressions: Primitive Types, Declaring Variables, Numeric Operators, Type Conversions, type of operator and Assignment statement, Screen Output and Keyboard Input. Object Creation and Modification. Handling Math, Number, Data and String Objects. Arrays, Functions, Constructors.

Introduction to JavaScript based Framework: Angular JS: Getting started, Model View Controller Architecture, Benefits and Philosophy of Angular. Building and Bootstrapping Angular JS Applications.

(8 Hours)

UNIT 4:

Handling structured and unstructured data store

Introduction to XML and JSON: Introduction to XML: Elements, attributes, documents, declaration, encoding, validation. Introduction to JSON, Array literals, Object literals, Mixing literals, JSON Syntax, JSON Encoding and Decoding, JSON versus XML.

Database Access through the Web: Relational database, introduction to SQL, the MySQL database.

(7 Hours)

UNIT 5:

Introduction to Server Side scripting and framework

An

Introduction to PHP: Overview and uses of PHP, General Syntactic structure, Primitives, Operations and Expressions. Control statements, Arrays, Functions, Pattern Matching, Form Handling, Cookies and Session Tracking. Database Access with PHP and MySQL. Understanding PHP frameworks.

(7 Hours)

Text Books:

Sl. No.	Content
1.	Programming the World Wide Web by Robert W. Sebesta, 7th Edition, Pearson Education, 2014.
2.	Learning Bootstrap, Arvind Shenoy, Ulrich Sossou, Packt, Publications (Open Source Publishers)
3.	Shyam Seshadri, Brad Green ,Angular JS: Up and Running: Enhanced Productivity with Structured Web Apps, , O'Reily Media, 2015

Reference Books:

Sl. No.	Content
1.	Ben Henick, O'Reilly, <i>HTML & CSS: The Good Parts</i> , First edition, O'Reilly Media, Original first release 2010.
2.	Crockford, O'Reily , <i>JavaScript: The Good Parts</i> , First edition, O'Reily Media, First Original release 2008.
3.	Nicholas C. Zakas, <i>Professional JavaScript for Web Developers</i> , Third edition, WROX, 2011.
4.	Kogent Learning Solutions Inc., <i>HTML 5 Black Book: Covers CSS3, Javascript, XML, XHTML, AJAX, PHP and jQuery</i> , Fifth Paperback, Dreamtech, 2013.

5.	Adam Trachtenberg, <i>PHP Cookbook: Solutions and Examples for PHP Programmers</i> , Third edition, O'ReillyMedia, 2014.
6.	Ben Henick, O'Reilly, <i>HTML & CSS: The Good Parts</i> , First edition, O'Reilly Media, Original first release 2010.
7.	Benjamin Jakobus, Jason Marah, <i>Mastering Bootstrap 4</i> , Edition 2016, Packet Publishing.

Online Courses and Video Lectures:

Sl. No.	Content
1.	https://www.w3schools.com/html/default.asp
2.	https://www.tutorialspoint.com/html5/html5_overview.htm
3.	https://www.w3schools.com/css/default.asp
4.	https://www.tutorialspoint.com/xml/index.htm
5.	https://www.w3schools.com/bootstrap4/bootstrap_get_started.asp
6.	https://getbootstrap.com/docs/4.4/getting-started/introduction/
7.	http://www.tutorialspoint.com//php/index.htm

List of lab programs:

1. To design user interface for a given scenario using basic HTML tags
2. To demonstrate the concepts of CSS selectors and conflict resolution
3. To demonstrate the concepts of various UI components of Bootstrap
4. To demonstrate the concepts of syntactic structures of JavaScript
5. To demonstrate the Client side validation using JavaScript
6. To construct a JSON and XML structures
7. To demonstrate the working of Server side program with forms using PHP
8. To demonstrate the database access with PHP

Course Outcomes:

At the end of the course the student will be able to:

CO1	Apply the knowledge of HTML, CSS, Bootstrap, Client and Server-side technologies using structured and unstructured data for a given use case	PO1 (3)
CO2	Analyse the web technologies required for building a web page for a use case	PO2 (2)
CO3	Implement programs and develop an interactive and responsive web pages for a given scenario	PO4(3), PO5 (3)
CO4	Work in team, to design an interactive website for a real world scenario	PO3 (1)



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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER – I

COURSE TITLE	MATHEMATICS AND STATISTICAL FOUNDATIONS	CREDITS	4
COURSE CODE	20MCA1BSMS	L-T-P	3-1-0
CIE	40	SEE	60

Prerequisites: None

UNIT 1: The Language of Logic

Propositions, Logical Equivalences, Quantifiers, Arguments, Proof Methods.

(6 Hours)

UNIT 2: Relations

Relations and Digraphs, Properties of Relations, Operations on Relations, Equivalence Relations, Partial and Total Orderings Recursively defined functions, Solving recurrence relations, *Applications:* Lucas Numbers, Tower of Brahma, Hand Shake Problem

(8 Hours)

UNIT 3: Combinatorics and Statistical Distributions

The Fundamental counting principles, Permutations, Combinations, Probability Distribution: Mean and Variance of a Probability Distribution, Concepts related to Binomial Distribution, Poisson Distribution, Normal Distribution, Normal Approximation to the Binomial Distribution.

(8 Hours)

UNIT 4: Hypothesis Testing:

One Sample Tests (Large Samples): Introduction, Hypothesis Testing, Procedure for Hypothesis Testing, all types of One-tailed and Two-tailed Tests. Chi-Square Test: Chi-Square one Sample Test, Steps involved in the Process, Contingency Tables, Testing Hypothesis for Independence of Two Categories.

(8 Hours)

UNIT 5: Regression and Correlation Analysis: Scatter Diagram, Linear Regression Equation, Standard Error of the estimate, Correlation Analysis, Measures of Variation, Coefficient of Determination. **(6 Hours)**

Text Books:

Sl. No.	Content
1.	Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2004.
2.	JIT S Chandan, Statistics for Business and Economics, First Edition, Vikas Publishing House Pvt. Ltd, 1998.

Reference Books:

Sl. No.	Content
1.	Kenneth Rosen, Discrete Mathematics and Its Applications, 7 th Edition, TMH, 2012
2.	Jean-Paul Tremblay, R Manohar, Discrete Mathematical Structures With Applications To Computer Science, McGraw Hill Education; 1 edition (2 February 2001)
3.	Kishor S. Trivedi, Probability & Statistics with Reliability, Queuing and Computer Science Applications, Wiley India Pvt. Ltd., 2002
4.	Richard I. Levin, David S. Rubin, Statistics for Management, Seventh Edition, Prentice-Hall of India, Pvt. Ltd., 2000

E- Books and Online Course Materials:

Sl. No.	Content
1	SudarshanIyengar, Discrete Mathematics, https://onlinecourses.nptel.ac.in/noc18_cs53/course
2	Kamala Krithivasan, Discrete Mathematical Structures, http://nptel.ac.in/courses/106106094/
3	Somesh Kumar, IIT Kharagpur, http://www.nptelvideos.in/2012/11/probability-and-statistics.html , 2012
4	MatthjisRooduijn, Basic Statistics, Coursera program https://www.coursera.org/learn/basic-statistics#about

Course Outcomes:

At the end of the course the student will be able to:

CO1	Explain the concepts of Mathematical Structures and Statistics	--
CO2	Solve problems using various concepts of Mathematical Structures/statistical techniques.	PO1 (3)
CO3	Analyse the data using statistical/mathematical techniques.	PO2(1)
CO4	Design a prediction model for a given data using statistical techniques.	PO3(1)



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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER – I

COURSE TITLE	SOFTWARE ENGINEERING	Credits	3
COURSE CODE	20MCA1PCSE	L-T-P	2-1-0
CIE	40	SEE	60

UNIT 1:

Introduction:

The Software Engineering Discipline - Its Evolution and impact: Evolution of an Art into an Engineering Discipline, A solution to the Software Crisis. Software Development Projects: Programs versus Products, Types of Software Development Projects, Software projects being undertaken by Indian Companies. Exploratory Style of Software Development: Perceived Problem Complexity: An Interpretation Based on Human Cognition Mechanism, Principles Deployed by Software Engineering to Overcome, Why Study Software Engineering. Emergence of software Engineering: Early Computer Programming, High Level Language Programming, Control Flow - Based Design, Data Structure- Oriented Design, Data Flow- Oriented Design, Object- Oriented Design, What Next? Other development, Notable Changes in Software Development Practices, Computer Systems Engineering **(5 Hours)**

UNIT 2:

Software Process Models:

Why Use a life cycle model? Why Document a Life Cycle Model? Phase Entry and Exit Criteria. Classical Waterfall Model: Phases of Classical Waterfall Model, Shortcomings of the Classical Waterfall Model, Is the Classical Waterfall Model Useful at All? Iterative Waterfall Model: Phase Containment of Errors, Shortcomings of the Iterative Waterfall Model. Prototyping Model, Evolutionary Model: Life Cycle Activities. Spiral Model: Risk Handling in Spiral Model, Phases of the Spiral Model, Pros and Cons of the Spiral Model, Spiral Model as a Meta Model. Comparison of different Life Cycle Models. Selecting an Appropriate Life Cycle Model for a Project. Agile Development: What is Agility, Agility and Cost of Change, what is an Agile process? eXtreme Programming (XP), Other Agile Process Models, Knowledge Driven Development (KDD). **(5 Hours)**

UNIT 3:

Requirement Analysis and Design:

Requirements Gathering and Analysis: Requirements Gathering, Requirements Analysis.

Software Requirements Specification (SRS): Characteristics of a Good SRS Document, Examples of Bad SRS Documents, Important Categories of Customer Requirements, Functional Requirements, how to Identify the Functional Requirements? How to Document the Functional Requirements? Traceability, Organization of SRS document.

Software Design: Outcome of a Design Activities, Classification of Design Activities, Analysis versus Design, how can We Characterize a Good Software Design? Approaches to Software Design.

Function - Oriented Design: Data Flow Diagrams

Object - Oriented Design: Unified Modelling Diagrams (UML)- Use case diagram, Class diagram, Sequence diagram, Activity diagram, Interaction diagram, and state chart diagram
(6 Hours)

UNIT 4:

Software Reliability and Quality Management

Software reliability: Hardware v/s Software reliability, Reliability Metrics, Reliability Growth Modelling. Software Quality, Software Quality Management System, Evolution of Quality Systems, Product Metrics v/s Process Metrics. Testing: Basic Concepts and Terminologies, Why Design Test Cases? Testing in the Large v/s Testing in the Small, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Integration testing, System testing, some general issues Associated with testing. Test Documentation, regression testing.

(5 Hours)

UNIT 5:

Problem Space Understanding

Difference between Problem Understanding and Problem Space Understanding, Knowledge management and its relevance in software development, Domain knowledge framework - to learn multiple domains in a structured way, Problem Space Understanding via domain knowledge and enterprise knowledge, Role of Problem Space Understanding in software development, Evolution of project knowledge into Knowledge Driven Development (KDD).
(4 Hours)

Text Books:

Sl. No.	Content
1.	Fundamentals of Software Engineering, Rajib mall, PHI Learning, Fifth Edition
2.	Software Engineering, A Practitioner's Approach, Roger S. Pressman, McGraw Hill International Edition, Seventh Edition.
3.	Knowledge Driven Development – Bridging Waterfall and Agile Methodologies, Manoj Kumar Lal

Course Outcomes:

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

CO1	Describe the concepts of Software Engineering	---
CO2	Apply the principles of Software Engineering for real world scenarios.	PO1(2)
CO3	Analyse various methodologies of software development for given scenarios.	PO2(2)
CO4	Work in a team to create artifacts by choosing real world problems related to societal/health/legal aspects.	PO10(2), PO11(1)



B. M. S. COLLEGE OF ENGINEERING BENGALURU-19

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DEPARTMENT OF COMPUTER APPLICATIONS SEMESTER – I

COURSE TITLE	COMPUTER NETWORKS	Credits	4
COURSE CODE	20MCA1PCCN	L-T-P	3-1-0
CIE	40	SEE	60

Prerequisites: None

UNIT 1: Introduction to Computer Networks, Protocol layers and Application Layer:

Computer Networks and the Internet: What is Internet? The network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and their Service Models

Application Layer: Principles of Network Applications, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, DNS-The Internet's Directory Service: Services provides by DNS, overview of how DNS works. **(7 Hours)**

UNIT 2: Transport Layer:

Introduction and Transport-Layer Services, Multiplexing and DE multiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Connections-Oriented Transport: TCP: TCP Connection, Segment structure, Round Trip Time estimation and Timeout. **(8 Hours)**

UNIT 3: The Network Layer:

Introduction, Virtual Circuit and Datagram Networks, What's inside a Router? The Internet Protocol (IP): Forwarding and Addressing in the Internet, Routing Algorithms, Routing in the internet: Intra-AS: RIP, Inter-AS: OSPF, Inter-AS: BGP. **(7 Hours)**

UNIT 4: The Link Layer: Links, Access Networks, and LANs:

Introduction to the link layer, Error-Detection and Correction Techniques, Multiple Access Links and Protocols: Channel Partition, Random Access protocols. **(7 Hours)**

UNIT 5:

Security in Computer Networks:

What is Network Security, principles of cryptography, message integrity and digital signatures, securing email. **(7 Hours)**

Text Books:

Sl. No.	Content
1.	James F Kurose and Keith W Ross “Computer Networking”: A Top-Down Approach (6th Edition), Pearson Publication 2017.

Reference Books:

Sl. No.	Content
1.	Andrew S. Tanenbaum and David J. Wetherill, “Computer Networks”, 5th edition, Prentice Hall, 2014.
2.	Larry L Peterson and Bruce S. Davie, "Computer Networks": A Systems Approach 6 th Edition, Morgan Kaufmann. 2016.
3.	Cisco Networking Academy Program, CCNA 1 and 2 Companion Guide 2016.

Course Outcomes:

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

CO1	Explain concepts of computer networks.	---
CO2	Apply the concepts of computer networks /algorithms/protocols for given problem.	PO1(3)
CO3	Analyze the given scenario and arrive at computer network based algorithm / protocol / solution for the scenario.	PO2(2)
CO4	Perform in a team, prepare a poster to demonstrate how the field of computer networks makes a path into the interdisciplinary research.	PO9(2), PO10(2), PO11(1)



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**DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – I**

COURSE TITLE	PROFESSIONAL COMMUNICATION & ETHICS	Credits	2
COURSE CODE	20MCA1HSPE	L-T-P	1-1-0
CIE	40	SEE	60

Prerequisites: None.

UNIT 1:

Introduction to Communication: Importance, Basics, purpose & audience, cross cultural communication, Language as a tool, Communicative Tools LSRW, Modes of Communication, Barriers to Communication: Noise, Classification of barriers, Effective Presentation Strategies: Planning, outlining, structuring, Nuances of Delivery, Controlling nervousness & stage Fright, Visual aids in presentation.

(5 Hours)

UNIT 2:

Group Communication: Forms of group communication, use of body language, discussion, group discussion. Paragraphs & Essays: Expressing idea, Paragraph construction, Paragraph length, paragraph pattern, Kinds of paragraph, writing first draft, revising & finalising, Essay, Letters & Email: Letter writing, business letter, cover letter, resume, Email.

(5 Hours)

UNIT 3:

Reports: Importance, objectives, characteristics, categories, structure, types, Research Papers: Characteristics, Components, referencing: Evaluating sources of information, Bibliography, referencing.

(5 Hours)

UNIT 4:

An Overview of Ethics: What is ethics? Ethics for business world, Including Ethical Considerations in Decision Making, Ethics in Information Technology, Ethics for IT Workers & IT users: IT Professionals, IT Users.

(5 Hours)

UNIT 5:

Privacy: Privacy protection & laws, Key privacy & anonymity issues,

Social Networking: What is social networking website, Business applications of online social networking, social networking ethical issues, online Virtual world.

(4 Hours)

Text Books:

Sl. No.	Content
1	“Technical Communication-Principles & Practice”, Meenakshi Raman & Sangeetha Sharma, 2 nd Edition, Oxford University Press.
2.	“Ethics in Information Technology”, George W Reynolds, 5 th Edition, Cengage.

Reference Books:

Sl. No.	Content
1	Basic Business communication – Skills for Empowering the Internet generation” 10 th Edition, Lesikar & Flatley, Tata McGraw Hill.

Course Outcomes:

At the end of the course, the students will be able to:

CO1	Explain concepts of Oral & Written communication	---
CO2	Apply oral & written communication skill for various use cases.	PO1(3), PO6(1)
CO3	Perform in a team to make an effective oral presentation.	PO9(1)



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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – I

COURSE TITLE	MOOC COURSE	Credits	Non Credited course
COURSE CODE	20MCA1NCA1	L-T-P	0-0-0
CIE	NA	SEE	NA

Prerequisites: None

Guidelines:

This is not a team work; a student has to register and complete the course individually. Students shall take up any online courses which is chosen in the area of Design thinking or a similar course.

The course duration must span 4-6 weeks. Student must produce the hardcopy of the registration detail / send an email to the faculty coordinator about the confirmation details of registration for the online course taken up at the beginning of the semester.

This course does not have any CIE or SEE; however, student must produce the completion certificate for the course taken up in this semester / period. The result is declared either pass or fail, based on the completion of the course in the stipulated time.

Course Outcomes:

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

CO1	Explain the concepts related to Design thinking or a related course.	--
CO2	Work effectively to engage in a lifelong learning	PO7(3)



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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – I

COURSE TITLE	Problem Solving and C Programming	Credits	Non Credited course
COURSE CODE	20MCA1NCBC**	L-T-P	1-0-2 (for instruction purpose only)
CIE	40	SEE	NA

NOTE: It is a bridge Course, only applicable for Non-Computer science students.

Pre-requisites: Basic concepts of Computers.

UNIT 1:

Introduction to Computer Problem-Solving: Introduction, The Problem-Solving Aspect, Top-down Design, Implementation of Algorithms, Program Verification, Efficiency of Algorithms, Analysis of Algorithms. Overview of Programming, Program Conversion, Interpreting and Executing Program, Kinds of Instructions – Procedure - Oriented and Object Oriented Approach, Problem-Solving Techniques. **(6 Hours)**

UNIT 2:

Problem solving (Algorithms): Fundamental Algorithms, Factoring Methods, Array Techniques, Text Processing and Pattern Searching. **(4 Hours)**

UNIT 3:

Basics: Data types, operators, priority of operators in evaluating an expression, control statements and loops. One and two-dimensional array, String handling, Structures and unions. Function Prototypes, Passing Arguments to a Function, Recursion. **(4 Hours)**

UNIT 4:

Pointers: Scope Rules, Storage Classes, Automatic Variables, External Variables, Static Variable Pointers Arithmetic, Character Array of Pointers, Dynamic Memory Allocation, Array of Pointer, Pointer to Arrays. Structures, Array of Structures, Structures within Structures, Pointer to Structures, Unions. **(4 Hours)**

UNIT 5:

C Pre-processor: Pre-processor Directive, Macro Substitution, File Inclusion Directive, Conditional Compilation.

Files: Basic File Operations, Error Handling, Command-Line Arguments, Dynamic Memory Allocation- Malloc, Calloc, Realloc, Free, Dynamic Arrays.

(6 Hours)

Text Books:

Sl. No.	Content
1.	Brian W Kernighan & Dennis Ritchie, The C programming language, Second edition, 1988

Reference Books:

Sl. No.	Content
1.	Frozen, A Structured Programming Approach Using C, Third edition, Cengage Learning, 2007
2.	Yashavant Kanetkar, Understanding pointers in C, Fourth edition, BPB publication, 2009

List of Lab Programs

1. Simple C Programs.
2. Programs using nested if.
3. Programs using switch statement.
4. Programs using while statement.
5. Programs using for statement.
6. Programs using nested for statement.
7. Programs using one-dimensional array concept.
8. Programs using two-dimensional array concept.
9. Programs on string handling functions.
10. Programs on Structures and Unions.
11. Programs on pointers.
12. Programs on macros.
13. Programs on Files.

Course Outcomes:

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

CO1	Describe the concepts of problem solving
CO2	Apply the problem solving techniques to solve computing problems.
CO3	Analyse the problem and obtain a solution.
CO4	Implement problem solving concepts using C programming language.



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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – II

COURSE TITLE	DATA STRUCTURES AND ALGORITHMS	Credits	4
COURSE CODE	20MCA2PCDS	L-T-P	3-0-1
CIE	40	SEE	60

Prerequisites: 20MCA1PCPY, 20MCA1PCUS

Unit 1:

Notion of Algorithm, Informal introduction to programming, algorithms and data structures via GCD Algorithm, Data Structures- Linear Array: Representation in memory Stacks and Queues: Implementation using Array. Circular queue implementation using array. **(8 Hours)**

Unit 2:

Linked lists: Definition, operations on singly linked list, Circular linked List and doubly linked list Stacks and Queues implementation using Linked Lists. **(7 Hours)**

Unit 3:

Asymptotic Notations, Mathematical Analysis of Non Recursive algorithms: Selection, Bubble Sort, Insertion Sort and Brute Force String Matching Algorithm Mathematical Analysis of Recursive algorithms: Tower of Hanoi, Merge sort, Quicksort. **(7 Hours)**

Unit 4:

Introduction to trees, binary trees, Representation of Binary trees using arrays and lists, Binary tree traversals, Binary search trees, Heaps, Huffman's Algorithm, Backtracking: N Queens problem. **(7 Hours)**

Unit 5:

Graph Representation, Traversal-BFS and DFS, Topological Ordering, Warshall's and Floyd's Algorithm, Minimum Spanning Tree: Kruskal's /Prim's algorithm, Single Source Shortest path: Dijkstra's Algorithm. **(7 Hours)**

Text Books:

Sl. No.	Content
1.	Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
2.	Data Structures And Algorithm Schaum Series.

Reference Books:

Sl. No.	Content
1	Howrowitz E., Sahani S., Rajasekharan S: Computer Algorithms, Galgotia Publication 2001.
2	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
3	YedidyahLangsam and Moshe J. Augenstein and Aaron M Tenanbanum, Data Structures Using C and C++, 2nd Edition, Pearson Education Asia, 2002
4	Richard F. Gilberg and Behrouz A. Fourouzan, Data structures-A pseudocode approach with C, 2nd Edition, Cengage Learning, 2005
5	Jean-Paul Tremblay, Paul G. Sorenson, An Introduction to Data Structures With Application, 2nd Edition, Mcgraw Hill Computer Science Series, 2001

E- Books and Online Course Materials:

Sl. No.	Content
1	Schaum Lipschutz, Data Structures With C, https://archive.org/details/DataStrucuresWithCBySchaumLipschutz
2	ISRD group, Data Structures With C, http://ebooksfree678.blogspot.in/2012/09/data-structures-using-c-mcgraw-hill.html
3	Data structure through C, Yashavant Kanitkar, http://e-book-expedition.blogspot.in/2012/07/download-data-structure-through-c-by.html

Online Courses and Video Lectures:

Sl. No.	Content
1.	C Programming and Data structures, Prof. P Chakraborty, http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures
2	Data structures and algorithms, Dr. Naveen Garg, http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
3	2016: Programming, Data structures and Algorithms, Dr. Shankar Balachandran, Dr. N S Narayanswamy, Dr. Hema A Murthy, https://onlinecourses.nptel.ac.in/noc16_cs06/preview
4	Prof. Abhiram G Ranade, Design and Analysis of Algorithms, http://nptel.ac.in/courses/106101060/
5	Prof. Madhavan Mukund, Programming, Data Structures and Algorithms in Python, https://nptel.ac.in/courses/106/106/106106145/
6	Prof. Madhavan Mukund, Design and Analysis of Algorithms, https://nptel.ac.in/courses/106/106/106106131/

Course Outcomes:

At the end of the course the student will be able to:

CO1	Explain the concepts of data structures /analysis of Algorithms	-
CO2	Apply concepts of data structures/analysis of algorithms for various problems	PO1(3)
CO3	Evaluate the algorithm for its time complexity for the given input	PO2(2)
CO4	Implement data structures, sorting and searching methods using Modern tools	PO5(3)
CO5	Design an algorithm to solve a problem in a team by choosing an appropriate data structure.	PO3(1), PO5(3), PO11(1)

List of Lab Programs

1. Program to simulate array operations
2. Program to simulate the working of stack
3. Program to simulate the working of queue
4. Simulate the working of a singly linked list
5. Simulate the working of a doubly linked list
6. Simulate the working of circular linked list
7. Implement Quick Sort
8. Implement Merge Sort
9. Create a binary tree and implement the tree traversal techniques
10. Implement search using BST
11. Compute the transitive closure of a given directed graph using Warshall's algorithm.
12. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths Algorithm.



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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – II

COURSE TITLE	MACHINE LEARNING	Credits	4
COURSE CODE	20MCA2PCML	L-T-P	3-0-1
CIE	40	SEE	60

Prerequisites: Basics of Statistics

UNIT 1:

Machine Learning basics and applications: What is machine learning? Key terminology, Key tasks of machine learning, how to choose the right algorithm? Steps in developing a machine learning application. *Machine learning applications in Data mining:* Financial data analysis, Retail and Telecommunication Industries, Science and Engineering, Intrusion detection and Prevention, Recommender Systems. Getting to Know Your Data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity.

(7 Hours)

UNIT 2:

Data Pre-processing: An Overview, Data Cleaning, Data Reduction - Overview of Data Reduction Strategies, PCA, Attribute Subset Selection, Histograms, Clustering, Sampling; Data Transformation and Data Discretization - Data Transformation by Normalization, Discretization by Binning, Discretization by Histogram Analysis, Discretization by Cluster, Decision Tree, and Correlation Analyses.

(7 Hours)

UNIT 3:

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts, Frequent Item set Mining Methods, Which Patterns Are Interesting? Pattern Evaluation Methods, Mining Rare Patterns and Negative Patterns.

(7 Hours)

UNIT 4:

Classification: Basic Concepts: Basic Concepts, Decision Tree Induction: Attribute Selection Measures Tree Pruning, Bayes Classification Methods, Rule-Based Classification, k-Nearest Neighbour method. Model Evaluation and Selection: Metrics for Evaluating Classifier Performance, Cross-validation, Bootstrap. **(8 Hours)**

UNIT 5:

Cluster Analysis: Basic Concepts and Methods: Cluster Analysis, partitioning based methods: k-Means; Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering, Density-Based Methods: DBSCAN, Grid based methods: STING, Outlier Detection: Outliers and Outlier Analysis, Outlier Detection Methods. **(7 Hours)**

Lab Experiments:

Implement the following Concept:

Programs related to Data Visualization

1. Programs related to Frequent Pattern Mining
2. Programs related to Classification
3. Programs related to Cluster Analysis

Text Books:

Sl. No.	Content
1.	Peter Harrington, Machine Learning in action, Dreamtech press, 2015
2.	Jiawei Han and MichelineKamber, "Data Mining: Concepts and Techniques", Third Edition, (The Morgan Kaufmann Series in Data Management Systems), 2012.

Reference Books:

Sl. No.	Content
1.	EthemAlpaydin, Introduction to Machine Learning 3 rd edition, 2014 MIT Press
2.	Nina Zumel, and John Mount, "Practical Data Science with R", Manning Publications Co., NY, 2014, URL: https://www.manning.com/books/practical-data-science-with-r
3.	Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson education 2016.
4.	K.P. Soman, ShyamDiwakar, and V. Ajay, "Insight into Data mining: Theory and Practice", Prentice Hall of India Ltd, New Delhi, 2009.
5.	Ian H. Witten, Eibe Frank, Mark A. Hall, "Data Mining: Practical Machine Learning Tools and Techniques", Elsevier, 2011.

Online Courses and E- Books:

Sl. No.	Content
1.	Yanchang Zhao, R and Data Mining: Examples and Case Studies, http://www.RDataMining.com , 2015
2.	ZicoKolter, Carnegie Mellon University, Practical Data Science, http://www.datasciencecourse.org/
3.	NandanSudarsanam, IITM, Introduction to Data analytics, http://nptel.ac.in/courses/110106064/1
4.	Data mining courses, https://www.coursera.org/specializations/data-mining

Course Outcomes:

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

CO1	Explain the concepts related to Machine Learning.	--
CO2	Apply concept of Machine Learning.	PO1(3)
CO3	Design Machine learning models for a scenario	PO3(2)
CO4	Interpret the data/model to draw conclusions related to a scenario under study	PO4(2)
CO5	Develop ML programs using a modern tool	PO5(3)



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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – II

COURSE TITLE	JAVA PROGRAMMING	Credits	4
COURSE CODE	20MCA2PCJP	L-T-P	3-0-1
CIE	40	SEE	60

Prerequisites: Familiar with Object Oriented Principles

Refresher Course

An Introduction to Java

Java as a Programming Platform, The Java Buzzwords: Simple, Object-Oriented, Robust, Multithreaded, Architecture-Neutral, Interpreted and High Performance, Distributed, Dynamic, Java Applets and the Internet, A Short History of Java, Common Misconceptions about Java, The Java Programming Environment, Installing the Java Development Kit, Using the Command-Line Tools, Using an Integrated Development Environment, Fundamental Programming Structures in Java, A Simple Java Program, Comments, Data Types, Variables and Constants, Operators, Strings, Input and Output, Control Flow, Big Numbers, Arrays.

Java Fundamentals

The History and Philosophy of Java, The Origins of Java, Javas Lineage: C and C++, How Java Impacted the Internet, Javas Magic: The Bytecode, Moving Beyond Applets, A Faster Release Schedule, The Java Development Kit, A First Simple Program, Entering the Program, Compiling the Program, The First Sample Program Line by Line, Handling Syntax Errors, A Second Simple Program, Another Data Type, Try: Converting Gallons to Liters, Two Control Statements, The if Statement, The for Loop, Create Blocks of Code, Semicolons and Positioning, Indentation Practices, Try: Improving the Gallons-to-Liters Converter, The Java Keywords, Identifiers in Java, The Java Class Libraries, Introducing Data Types and Operators, Why Data Types Are Important, Java's Primitive Types, Integers, Floating-Point Types, Characters, The Boolean Type, Dynamic Initialization, The Scope and Lifetime of Variables, Operators, Arithmetic Operators, Increment and Decrement, Relational and Logical Operators, Short-Circuit Logical Operators, The Assignment Operator, Shorthand Assignments, Type Conversion in Assignments, Casting Incompatible Types, Operator Precedence, Display a Truth Table for the Logical Operators,

Expressions, Type Conversion in Expressions, Spacing and Parentheses, Program Control Statements,

Input Characters from the Keyboard, The if Statement, Nested ifs, The if-else-if Ladder, The switch Statement, Nested switch Statements, Start Building a Java Help System, The for Loop, Some Variations on the for Loop, Missing Pieces, The Infinite Loop, Loops with No Body, Declaring Loop Control Variables Inside the for Loop, The Enhanced for Loop, The while Loop, The do-while Loop, Improve the Java Help System, Use break to Exit a Loop, Use break as a Form of goto, Use continue, Nested Loops

Java Performance

A Brief Outline, Platforms and Conventions, Java Platforms, Hardware Platforms, The Complete Performance Story, Write Better Algorithms, Write Less Code, Oh, Go Ahead, Prematurely Optimize, Look Elsewhere: The Database Is Always the Bottleneck, Optimize for the Common Case.

UNIT 1:

Introducing Classes, A Closer Look at Methods and Classes, Inheritance, Packages and Interfaces, Exception Handling, Multithreaded Programming.

(7 Hours)

UNIT 2:

Enumerations, Autoboxing and Annotations, I/O Basics, Generics, Modules, String Handling.

(7 Hours)

UNIT 3:

Java.util: The Collections Framework, Input/Output: Exploring java.io, Networking.

(8 Hours)

UNIT 4:

Event Handling, Introducing the AWT: Working with Windows, Graphics, and Text, Using AWT Controls, Layout Managers, and Menus.

(7 Hours)

UNIT 5:

The Stream API, Regular Expressions and Other Packages, Introducing Swing, Exploring Swing, Introducing Swing Menus, Applying Java Overview.

(7 Hours)

Text Book:

Sl .No	Contents
1.	Java: The Complete Reference, Eleventh Edition, Herbert Schildt, McGraw-Hill, December 2018, ISBN: 9781260440249.

Reference Books:

Sl .No	Contents
1.	Core Java Volume I Fundamentals, Eleventh Edition, Cay S. Horstmann, Pearson, August 2018, ISBN: 9780135167199.
2.	Java: A Beginner's Guide, 8th Edition, Herbert Schildt, McGraw-Hill November 2018, ISBN: 9781260440225.
3.	Java Performance, 2nd Edition, Scott Oaks, O'Reilly Media, Inc., February 2020, ISBN: 9781492056119.

List of Lab Programs – Integrated with Java Programming Theory:

1. Introduction to JDK and Multiple IDEs
2. Define Class using Packages and Interfaces
3. Implement Exception Handling
4. Demonstrate the functionality of Java Threads
5. Develop Network based Programs
6. Choose appropriate Java Libraries / Collection Framework to develop java program based on given scenario
7. Design user friendly interface using AWT & Swings

Course Outcomes:

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

CO1	Explain the concepts of Java Programming	--
CO2	Develop Java Programs for a given scenario.	PO1 (3), PO2(1)
CO3	Design GUI's using Java Collections and Libraries	PO3(2)
CO4	Conduct experiments using Java programming language	PO4(2), PO5(2)



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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – II

COURSE TITLE	DATABASE MANAGEMENT SYSTEMS	Credits	3
COURSE CODE	20MCA2PCDB	L-T-P	2-1-0
CIE	40	SEE	60

Prerequisites: None

Unit 1:

Introduction: An example; Characteristics of Database approach; Actors on the screen; workers behind the scene; Advantages of using DBMS approach, when not to use a DBMS.

Database System Concepts and Architecture: Data models, Schemas and instances; Three schema architecture and Data independence; Database languages and Interfaces; Classification of DBMS.

(5 Hours)

Unit 2:

Data Modeling Using the Entity–Relationship (ER) Model: Using High level conceptual Data model for database design; A sample database application; Entity types, Entity sets, attributes and keys; Relationship types, Relationship sets, Roles and Structural constraints, Weak Entity types, Refining an ER design for COMPANY database, ER diagrams, Naming conventions and Design issues. Relational Database Design by ER-to-Relational Mapping.

(5 Hours)

Unit 3:

Relational Data Model: Relational model concepts, Relational model constraints, Relational database schema, Update operations Update operations and dealing with constraint violations.

(4 Hours)

Unit 4:

SQL: SQL data definition and data types; Specifying constants in SQL; Basic Retrieval Queries in SQL; Insert, Delete and Update Statements in SQL; Additional Features of SQL. More complex SQL Queries, Specifying constraints as assertions and actions as triggers, View in SQL, Schema change statements in SQL.

(5 Hours)

Unit 5:

Basics of Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Multi-valued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. **(5 Hours)**

Text Books:

Sl. No.	Content
1.	RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems ,7th Edition, Pearson Education, 2016

Reference Books:

Sl. No.	Content
1.	Raghu Ramakrishna, Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw-Hill,2003.
2.	Coronel, Morris, Rob, Database principles fundamentals of design, Implementation and Management, Cengage Learning, 2014
3.	AbrahamSilerscharz, Henry F Korth, S Sudershan, Database system concepts, Sixth Edition, McgrawHill, 2011
4.	Jeffrey A. Hoffer, Mary B. Prescott, Fred R. McFadden, “Modern Database Management”, Prentice Hall, 8th Edition, ISBN-13: 978-0-13-033969-0

E- Books and Online Course Material:

Sl. No.	Content
1.	Silbertschat, Database system concepts, www.mhhe.com/silbertschat ,2011
2.	ElmaSri and Navathe : Fundamentals of Database Systems, http://www.aw.com/elmasri , http://www.aw.com/cssupport
3.	P .S. Gill, Database Management System, http://www.amazon.in/Database-Management-Systems-P-Gill/dp
4.	Raghu Ramakrishna, Database Management system, http://www.amfastech.com/2013/01/database-management-system-by-raghu.html

Course Outcomes:**At the end of the course, student will be able to:**

CO1	Explain the concepts of Database system.	---
CO2	Apply the concepts of relational Database for a scenario.	PO1(3)
CO3	Analyze and develop Data models for a scenario.	PO2(2)
CO4	Formulate and implement queries, using a RDBMS package.	PO3(2), PO5(3)
CO5	Design and build simple real-world database applications in a team and prepare a report.	PO7(1), PO9(1), PO11(1)



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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – II

COURSE TITLE	CLOUD COMPUTING	Credits	3
COURSE CODE	20MCA2PCCC	L-T-P	2-0-1
CIE	40	SEE	60

Prerequisites: None

UNIT 1:

Introduction:

Cloud Computing Basics: Cloud Computing Overview, Disambiguation – Just what is Cloud Computing? Cloud Components, Infrastructure, Services. Applications – Storage, Database Services. Intranet and the Cloud: Components, Hypervisor Applications. First Movers in the Cloud: Amazon, Google, Microsoft. Peer-to-Peer Systems, Delivery Models and Services, Ethical Issues, Cloud Vulnerabilities, Major Challenges faced by Cloud Computing, Grid Computing, Emerging through Cloud, Benefits of Cloud Computing, Why Cloud? Business and IT Perspective, Cloud and Virtualization, Cloud Services Requirements, Dynamic Cloud Infrastructure, Characteristics, Cloud Adoption, Cloud Rudiments: Cost Savings with Cloud, Benefits. Cloud Models: Service Models, Deployment Models. Cloud Services with examples: IaaS, PaaS and SaaS. Cloud based services and applications: Healthcare, Transportation Systems, Manufacturing Industry, Government, Education, and Mobile Communication. **(7 Hours)**

UNIT 2:

Your Organization and Cloud Computing

When you can use Cloud Computing: Scenarios, when you should not use Cloud Computing. Benefits. Security. Limitations: Sensitive Information, Applications Not Ready, Developing your Own Applications. Security Concerns: Privacy Concerns with a Third Party, are they doing enough to Secure It? Security Benefits. Regulatory Issues: No Existing Regulation, Government to the Rescue. Cloud Technologies: Virtualization, Load Balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, SDN, Network Function Virtualization, Map Reduce, Identity and Access Management, Service Level Agreements, Billing. **(7 Hours)**

UNIT 3:

Cloud Computing with Titans

Google: Google App Engine, Google Web Toolkit. EMC: Technologies, VMware Acquisition. NetApp: Offerings, Cisco Partnership. Microsoft: Azure Service Platform, Windows Live, Exchange Online, SharePoint Services, Microsoft Dynamics CRM. Amazon: Amazon EC2, Amazon SimpleDB, Amazon S3, Amazon CloudFront, Amazon SQS, Amazon EBS. Salesforce.com: Force.com, Salesforce.com CRM, AppExchange. IBM: Services, Movement to the Cloud, Security. Partnerships: Yahoo! Research, SAP and IBM, Hp, Intel, and Yahoo! IBM and Amazon. **(7 Hours)**

UNIT 4:

Cloud Services, Platforms

Compute Services: Amazon EC2, Google Compute Engine, Windows Azure Virtual Machines. Storage Services: Amazon S3, Google Cloud Storage, Windows Azure Storage. Database Services: Amazon RDS, Amazon DynamoDB, Google CloudSQL, Google Cloud Datastore, Windows Azure SQL Database, Windows Azure Table Service. Application Services: Application Runtimes and Frameworks, Queuing Services, e-mail Services, Notification Services, and Media Services. Content Delivery Services: Amazon CloudFront, Windows Azure Content Delivery Network. Analytics Services: Amazon EMR, Google Map Reduce Services, Google Big Query, Windows Azure HDInsight. Deployment & Measurement Services: Amazon Elastic Beanstalk, Amazon CloudFormation. Identity & Access Management Services: Amazon Identity & Access Management, Windows Azure Active Directory. Open Source Private Cloud Software: Cloud Stack, Eucalyptus, OpenStack. **(8 Hours)**

UNIT 5:

Dockers and Kubernetes

Understanding Dockers, The differences between dedicated hosts, virtual machines, and Docker, Running Dockers in Public Clouds, Docker Cloud, Docker on-cloud, Amazon ECS, Amazon Fargate, and Microsoft Azure Services. What is Kubernetes? Kubernetes Concepts, Kubernetes API, Amazon EKS, IBM Cloud Kubernetes Services. **(7 Hours)**

Text Books:

Sl. No.	Content
1	Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, Indian Edition, McGraw Hill Education.
2	Cloud Computing , A Hands-on Approach, ArshdeepBahga, Vijay Madisetti, Universities Press,
3	Cloud Computing, Theory and Practices, Dan C. Marinescu, Elsevier, Indian Reprint
4	Mastering Docker , Third Edition, Russ McKendrick, Scott Gallagher, Packt
5	Cloud Computing , Unleashing Next Gen Infrastructure to Application , Dr Kumar Saurabh, Wiley Third Edition
6	Mastering Kubernetes, Third Edition, Packt, Third Edition

Course Outcomes:

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

CO1	Explain the core concepts of the cloud computing paradigm and need for Cloud.	--
CO2	Apply the Cloud Computing Concepts to solve real world problems.	PO1(2)
CO3	Analyse various cloud programming models and apply them to solve problems on the cloud.	PO2(2)



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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – II

COURSE TITLE	ARTIFICIAL INTELLIGENCE AND DEEP LEARNING	Credits	3
COURSE CODE	20MCA2PEAI	L-T-P	3-0-0
CIE	40	SEE	60

Prerequisites: Mathematics and Statistical foundations

Unit 1:

What is AI? the state of the art, Intelligent Agents: Agents and environment, Good behavior: the concept of Rationality, The nature of environment, The structure of agents. Solving Problems by Searching: Problem-solving agents; Example problems. **(6 Hours)**

Unit 2:

Solving Problems by Searching Contd.: Searching for Solutions; Uninformed Search Strategies: Breadth First search, Depth First Search, Informed Search Strategies: Greedy best first search, A*search. Beyond classical search: Local search algorithms and Optimization problems. Adversarial search: Games, Optimal decisions in Games. **(7 Hours)**

Unit 3:

Logical Agents: Knowledge-based agents, The Wumpus world, Logic-Propositional logic, Propositional theorem proving, Agents based on propositional logic. First order logic: Syntax and Semantics, using first order logic, knowledge engineering in first order logic. **(8 Hours)**

Unit 4:

Fundamentals of Deep Networks: Neural networks, Training neural networks, Defining Deep Learning, Common architectural principles of Deep Networks-Parameters, Layers, Activation functions, Loss functions, Hyper parameters, Building blocks of Deep Networks-RBMs, and Auto encoders. **(7 Hours)**

Unit 5:

Major architectures of Deep Networks: Convolutional Neural Networks-Biological inspiration, Intuition, CNN architecture overview, Input Layers, Convolutional layers, pooling layers, Fully Connected layers, Recurrent Neural Networks-Modelling the time dimension, 3D Volumetric input, General RNN

architecture, LSTM networks, Domain specific Applications, when do I need deep learning?
(8 Hours)

Text Books:

Sl. No.	Content
1.	Stuart Russel, and Peter Norvig, Artificial Intelligence: A Modern Approach by, 3rd Edition, Pearson Education, 2015.
2.	Josh Patterson and Adam Gibson, Deep Learning, A practitioner's approach, First edition, Shroff Publishers and Distributors Pvt. Ltd., 2017.

Reference Books:

Sl. No.	Content
1.	Elaine Rich, Kevin Knight, Shivashankar B Nair, Artificial Intelligence, by: Tata McGraw Hill, 3rd edition. 2013
2.	Ian Good fellow and YoshuaBengio and Aaron Courville, Deep Learning, MIT Press, Jan 2017
3.	S Lovelyn Rose, L Ashok Kumar, and D KarthikaRenuka, Deep learning using Python, Wiley India Pvt. Ltd., 2019

Online Courses and E- Books

Sl. No.	Content
1.	Artificial Intelligence, Dash gupta (IITK), https://nptel.ac.in/courses/106/105/106105079/
2.	Andrew Ng, AI for everyone, coursera.org
3.	Deep learning Tutorial (Stanford university), http://deeplearning.stanford.edu/tutorial/
4.	Mitesh M Khapra (iitm), and SudarshanIyengar (IITR), Deep learning, https://nptel.ac.in/courses/106/106/106106184/

Course Outcomes:

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

CO1	Explain the concepts and applications of AI and Deep Learning.	--
CO2	Apply the concepts of AI to various problems	PO1 (3)
CO3	Use a modern deep learning tool for building models in a team	PO5 (1), PO11 (1)



B. M. S. COLLEGE OF ENGINEERING BENGALURU-19
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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – II

COURSE TITLE	CYBER SECURITY	Credits	3
COURSE CODE	20MCA2PECS	L-T-P	3-0-0
CIE	40	SEE	60

Prerequisite: None

Unit 1

Introduction to Cybercrime

Introduction, Cybercrime: Definition and Origins of the word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes. Categories of Cybercrime. How Criminals Plan Attacks? Social Engineering, Cyber stalking, Cybercafe and Cybercrimes, Botnets, Attack Vector, The Indian ITA 2000.

(7 Hours)

Unit 2

Tools and Methods used in Cybercrime

Introduction, Proxy Server and Anonymizers, Phishing, Password Cracking, Keyloggers and Spyware, Virus and Worms, DOS and DDOS attack, Attacks on Wireless Networks.

(7 Hours)

Unit 3

Cybercrime: Mobile and Wireless Devices

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing, Security Challenges posed by Mobile Devices, Device Related Security issues, Attacks on Mobile/Cell Phones.

(7 Hours)

Unit 4

Understanding Computer Forensics and Forensics of Handheld Devices

Introduction, historical background of Cyberforensics, Need for Computer Forensics, Cyberforensics and Digital Evidence, Digital Forensics Life Cycle. Forensics and Social Networking Sites: The Security / Privacy Threats. Understanding Cell Phone Working Characteristics, Hand-held devices and digital forensics. An illustration on Real life Use of Forensics

(8 Hours)

Unit 5

Cybercrime and Cyberterrorism: Social, Political Ethical and Psychological Dimensions

Introduction, Intellectual Property in the Cyberspace, The ethical dimension of Cybercrimes, The Psychology, Mindset and shoes of Hackers and Cybercriminals, Sociology of Cybercriminals and Information Warefare. **(7 Hours)**

Text Books:

Sl. No	Contents
1.	Nina Godbole and SunitBelpure Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by, Publication Wiley.

Reference Books:

Sl. No	Contents
1.	Marjie T. Britz - Computer Forensics and Cyber Crime: An Introduction - Pearson
2.	Chwan-Hwa (John) Wu,J. David Irwin - Introduction to Computer Networks and Cyber security – CRC Press
3.	Bill Nelson, Amelia Phillips, Christopher Steuart - Guide to Computer Forensics and Investigations - Cengage Learning

Course Outcomes:

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

CO1	Understand the concepts of Cyber Security	-
CO2	Apply appropriate techniques to prevent Cyber Security threats in the digital system	PO1(3)
CO3	Analyze the given scenario and suggest the tools or methods to overcome the Cyber Crimes.	PO2(1)
CO4	Work in a team and make an oral presentation on topics related to Cyber Attacks in handheld and wearable devices.	PO7(1), PO9(1) PO10(3), PO11(1)



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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – II

COURSE TITLE	USER INTERFACE AND USER EXPERIENCE	Credits	3
COURSE CODE	20MCA2PEUX	L-T-P	3-0-0
CIE	40	SEE	60

Prerequisites: None

UNIT 1:

What Users Do: A Means to an End, the Basics of User Research, Users' Motivation to Learn, The Patterns – Safe Exploration, Instant Gratification, Satisficing, Changes in Midstream, Deferred Choices, Incremental Construction, Habituation, Micro breaks, Spatial Memory, Prospective Memory, Streamlined Repetition, Keyboard Only, Other People's Advice, Personal Recommendations.
(7 Hours)

UNIT 2:

Information Architecture and Application Structure: The Big Picture, The Patterns – Feature, Search and browse, News Stream, Picture Manager, Dashboard, Canvas Plus Palette, Wizard, Setting Editor, Alternative Views, Many Workspaces, Multi-Level Help Making it Look Good: Visual Style and Aesthetics: Same content, Different styles, The Basics of Visual Design, What This Means for Desktop Applications, The Patterns: Deep Background, Few Hues, Many Values, Corner Treatments, Borders That Echo Fonts, Hairlines, Contrasting Font Weights, Skins and Themes.
(8 Hours)

UNIT 3:

Design and UX: Users Vs Life Cycles, Visual Design, Web standards, Potential Barriers to sustainable UX, designing for Emerging Technologies: Design for Disruption, Eight Design Tenets for Emerging Technology, Changing Design and Designing Change, Fashion with Function: Designing for wearable devices, the next big wave in Technology, the wearable market segments, Wearable are not able, UX (and Human) Factors to consider.
(7 Hours)

UNIT 4:

An Ecosystem of connected device: The concept of an Ecosystem, The 3Cs Framework: Consistent, Continuous and Complementary, Single Device Design is History, It's an Eco system, The Consistent Design Approach: What is consistent Design, Consistency in Minimal Interface, Page 56 of 139 Progressive Disclosure in Consistent Design, Beyond Device Accessibility, Devices are means not an end.

(7 Hours)

UNIT 5:

The Continuous and Complementary Design Approach: The continuous Design Approach: What is Continuous Design? Single Activity flow and the Sequenced Activity Flow. What is Complementary Design? Collaboration: Must-Have, Collaboration: Nice to have, Control: Nice to Have, Fascinating Use Cases: What do they mean for my work? Integrated Design Approaches: 3 Cs as building blocks: Beyond the Core Devices: The Internet of Things, The Internet of Things already there?

(7 Hours)

Text Books:

Sl. No.	Content
1.	Jenifer Tidwell, "Designing Interfaces", 2 nd Edition, Oreilly, 2015.
2.	Jonathan Follet, "Designing for Emerging Technologies- UX for Genomics, Robotics and The Internet of Things", 1st Edition, Oreilly, 2014.
3.	Michal Levin, "Designing Multi-Device Experiences", 1st Edition, Oreilly, 2014.
4.	Tim Frick, "Designing for Sustainability", 1st Edition, Oreilly 2016.

Reference Books:

Sl. No.	Content
1.	Ben Shneiderman, Plaisant, Cohen, "Jacobs: Designing the User Interface", 5th Edition, Pearson Education, 2010.
2.	Unger and Chandler, "A Project Guide to UX Design", 2 nd Edition, New Riders, 2012

Course Outcomes:

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

CO1	Explain the concepts related to User interface or User Experience.	--
CO2	Apply the knowledge of features, approach, patterns for designing User Interface or User Experience for a given scenario.	PO1(3)
CO3	Analyse the given features, parameters and patterns of User Interface or User Experience for a real world scenario.	PO2(2)
CO4	Perform in a team to makes oral presentation on the effects of Wearable devices on health and environment/Banking/Insurance etc.,	PO9(2) PO10(1)



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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – II

COURSE TITLE	R PROGRAMMING	Credits	3
COURSE CODE	20MCA2PERR	L-T-P	3-0-0
CIE	40	SEE	60

Prerequisites: 20MCA1PCPY, 20MCA1BSMS

UNIT - 1

Introduction, Reserved Words, Variables & Constants, Operators, Operator Precedence, Decision: if...else, if else () Function. for loop, while Loop, break & next, repeat Loop. **(7 Hours)**

UNIT - 2

Functions, Function Return Value, Environment & Scope, Recursive Function, R Infix Operator, switch, Vectors, Matrix, List, Data Frame, Factor. **(7 Hours)**

UNIT – 3

Descriptive statistics in R : Introduction, Data, Minimum and maximum, Range, Mean, Median, Mode, First and third quartile, Other quartiles, Interquartile range, Standard deviation and variance, Summary. **(7 Hours)**

UNIT - 4

Histogram, Bar plot, Coefficient of variation, Boxplot, Contingency table – Mosaic Plot.

Probability Distributions – Binomial, Bernoulli, Geometric, Poisson, Exponential, Normal, Uniform distributions. **(7 Hours)**

UNIT - 5

Correlation & Regression - Introduction, Correlation & Regression plot - Scatterplot, Line plot, Classification using logistic regression.

Hypothesis testing – Introduction, Hypothesis tests - Proportions, Diff between props, Mean, Diff between means, Diff between pairs, Goodness of fit test- Chi-square test. **(8 Hours)**

Course Outcomes

At the end of the course the student will be able to:

CO1	Write simple programs, using R programming constructs	PO5
CO2	Compute basic summary statistics	PO1
CO3	Design suitable visual plot for the given data set	PO3
CO4	Interpret data using appropriate descriptive statistics	PO4
CO5	Develop a data model to draw inferences using R programming in a team and submit report	PO3, PO4, PO5, PO11

Text Books:

Sl. No.	Content
1.	Vincent Zoonekynd, Statistics With R
2.	Salvatore S. Mangiafico, Summary and Analysis of Extension Program Evaluation in R.
3.	Hadley Wikham & Garrett Grolemond, R for Data Science, O'Reilly Publications

Reference Books:

Sl. No.	Content
1.	Garrett Grolemond, Hands-On Programming with R, O'Reilly publications
2.	Nina Zumel, Jahn Mount, Practical Data Science with R, dreamtech press
3.	Winston Chang, R Graphics Cookbook, O'Reilly Publications

E- Books and Online Course Materials:

Sl. No.	Content
1.	Learn R Programming https://www.datamentor.io/r-programming/
2.	Stat Trek Teach yourself statistics https://stattrek.com/
3.	Garrett Golemund, Hadley Wickham, R for Data Science, https://www.allitebooks.in/r-data-science/
4.	Emmanuel Paradis, R for Beginners https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf
5.	Brian S. Everitt, Torsten, Hothorn, A Handbook of Statistical Analyses Using R http://www.ecostat.unical.it/tarsitano/didattica/LabStat2/Everitt.pdf
6.	Antoine Soetewey, Descriptive statistics in R, https://www.statsandr.com/blog/descriptive-statistics-in-r/
7.	R Notes for Professionals https://goalkicker.com/RBook
8.	Norman Matloff, The art of R Programming -A Tour of Statistical Software Design, http://diytranscriptomics.com/Reading/files/The%20Art%20of%20R%20Programming.pdf
9.	Learn R Programming https://www.datamentor.io/r-programming/examples/



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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – II

COURSE TITLE	BIG-DATA ANALYTICS AND NOSQL	Credits	4
COURSE CODE	20MCA2PEBD	L-T-P	3 -1 -0
CIE	40	SEE	60

Prerequisites: None

UNIT 1:

Getting an Overview of Big Data: What is Big Data, History, Structuring data, Elements of BigData, Big Data Analytics, and Careers in Big data. Exploring the Use of Big Data in Business Context: Use of Big data in Social Networking, preventing fraudulent activities, Detecting fraudulent activities in Insurance sector, Retail industry.

Introducing Technologies for Handling Big Data: Distributed and parallel computing for big data, Introducing Hadoop, Cloud computing and Big Data, In-memory computing technology for Big Data.

Understanding Hadoop ecosystem: Hadoop ecosystem, HDFS, Mapreduce, YARN, HBase, Hive, Sqoop, Zookeeper, Flume, Oozie.

(8 Hours)

UNIT 2:

Understanding Map Reduce Fundamentals and HBase: The Map Reduce Framework, Techniques to Optimize Map Reduce jobs, Uses of Map Reduce, Role of HBase in Big data processing.

Understanding Big data Technology Foundations: Exploring the Big Data stack, Virtualization and Big data, and Virtualization approaches.

(7 Hours)

UNIT 3:

Exploring Hive: Introduction, Data types, Built-in functions, Hive DDL, Data manipulation, Data retrieval queries, Joins in Hive. Big Data Analysis Techniques: Quantitative analysis, Qualitative analysis, Data mining. Statistical analysis – A/B Testing, Correlations, Regression, Machine Learning – Classification, Clustering, Outlier detection, Filtering, Semantic analysis, Visual analysis, Case-study.

Variety of NoSQL Databases: Data management with distributed databases, ACID and BASE, Types of eventual consistency, Four types of NoSQL databases: Key-value pair databases, Document databases, Column family databases, Graph databases. **(7 Hours)**

UNIT 4:

Introduction to MongoDB: Introduction, Getting Started: Documents, Collections, Dynamic Schemas, Naming, Databases, Getting and Starting MongoDB, Introduction to the MongoDB Shell, Running the Shell, A MongoDB Client, Basic Operations with the Shell, Data Types, Basic Data Types, Dates, Arrays, Embedded Documents_id and ObjectIds, Creating, Updating, Deleting Documents, Querying. **(7 Hours)**

UNIT 5:

Graph Databases – Overview, Getting Started with Neo4j, Importing data into Neo4j: The four fundamental data constructs, How to start modelling for graph databases, What we know – ER diagrams and relational schemas, Introducing complexity through join tables, A graph model – a simple, high-fidelity model of reality, Graph modelling – best practices and pitfalls, Graph modelling best practices, Design for query-ability, Align relationships with use cases, Look for n-ary relationships, Granulate nodes, Use in-graph indexes when appropriate, Graph database modelling pitfalls, Using "rich" properties, Node representing multiple concepts. **(7 Hours)**

Text Books:

Sl. No.	Content
1	DT Editorial Services, “Big Data Black Book”, Dreamtech press, New Delhi, 2016.
2	Dan Sullivan, “NOSQL for mere mortals”, Pearson education, 1st edition, 2015.
3	Kristina Chodorow, “MongoDB: The Definitive Guide”, Second Edition, Oreilly.
4	Rik Van Bruggen, “Learning Neo4j - Run blazingly fast queries on complex graph datasets with the power of the Neo4j graph database”, PACKT Publishing.

Reference Books:

Sl. No.	Content
1	ShashankTiwari, “Professional NOSQL”, John Wiley India Pvt. Ltd., 2011.
2	Chris Eaton, Dirk Deroos, Tom Deutsch, George Lapis, and Paul Zikopoulos, “Understanding Big data”, McGraw Hill Education India Pvt. Ltd., 2012

Online resources:

Sl. No.	Content
1	NandanSudarsanam, IITM, Introduction to Data analytics, http://nptel.ac.in/courses/110106064/1
2	Data science Central, http://www.datasciencecentral.com
3	Data Science and Big data courses, https://www.udacity.com/courses/data-science

Course Outcomes:

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

CO1	Explain the concepts of Big data and NoSQL databases	--
CO2	Apply Big Data and NoSQL concepts for a scenario	PO1(3)
CO3	Use a modern analysis tool to process the big data related to an application	PO5(2)



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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – II

COURSE TITLE	WIRELESS AND SENSOR NETWORKS	Credits	4
COURSE CODE	20MCA2PEWS	L-T-P	3-1-0
CIE	40	SEE	60

Prerequisites: 20MCA1PCNW

UNIT 1:

Mobile Computing Architecture, Access Procedures and Emerging Technologies: Mobile Computing Architecture: History of Computers, History of Internet, Internet – The Ubiquitous Network, Architecture for Mobile Computing, Three-tier Architecture, Design Considerations for Mobile Computing.

Access Procedure: Evolution of Telephony, Multiple Access Procedure – FDMA, TDMA, CDMA and SDMA.

Emerging Technologies: Introduction, Bluetooth, Radio Frequency Identification (RFID), Wireless Broadband (WiMAX), Mobile IP.

(7 Hours)

UNIT 2:

Wireless Networks 1- GSM:

Global Systems for Mobile Communication (GSM) and Short Message Services (SMS).

GSM: GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management.

SMS: Mobile Computing over SMS, Short Message Service, and Value added services through SMS.

(7 Hours)

UNIT 3:

Wireless Networks 2- GPRS, CDMA and 3G:

General Packet Radio Services (GPRS): GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Limitations of GPRS and Billing and Charging in GPRS.

CDMA and 3G: Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G.

(8 Hours)

Unit4:

Wireless Sensor Networks (WSN)-I: Introduction Background of Sensor Network Technology, Applications of Sensor Networks, Basic Sensor Network Architectural Elements, Brief Historical Survey of Sensor Networks, Challenges and Hurdles. Applications of Wireless Sensor Networks: Introduction, Range of Applications, Examples of Category 2 WSN Applications and Category 1 WSN Applications, Another Taxonomy of WSN Technology. Operating Systems for Wireless Sensor Networks: Introduction, Operating System Design Issues, Examples of Operating Systems. **(7 Hours)**

Unit5:

Wireless Sensor Networks (WSN)-II

Basic Wireless Sensor Technology: Sensor Node Technology, Hardware and Software, Sensor Taxonomy, WN Operating Environment, WN Trends. Routing Protocols in Wireless Sensor Networks: Introduction, Data Dissemination and Gathering. Routing Challenges and Design Issues in WSN. WSN Routing Techniques, Flooding and Its variants, Low-Energy Adaptive Cluster. **(7 Hours)**

Text Books:

SL. No	Contents
1.	Ashok Talukder, Ms Roopa Yavagal, Mr. Hasan Ahmed “Mobile Computing, Technology, Applications and Service Creation”, 2nd Edition, Tata McGraw Hill, 2015.
2.	KazemSohraby, Daniel Minoli, TaiebZnati, “Wireless Sensor Networks Technology, Protocols, and Applications”, 2015, Wiley India Pvt. Ltd.

References:

SL. No	Contents
1.	Raj Kamal, “Mobile Computing”, 2ndEdition, Oxford University Press, 2007.
2.	ItiSahaMisra, “Wireless Communications and Networks, 3G and Beyond”, 2nd Edition, Tata McGraw Hill, 2013.
3.	Reza B’Far, “Mobile Computing Principles – Designing and Developing Mobile Applications with UML and XML”, 5th Edition, Cambridge University Press, 2006.

4.	Uwe Hansmann, LotharMerk, Martin S Nicklous and Thomas Stober: “Principles of Mobile Computing”, 2nd Edition, Springer International Edition, 2003.
5.	Jochen Schiller, “Mobile Communication”, Pearson Publication, 2004.
6.	A. Goldsmith, "Wireless Communications," Cambridge University Press, 2005.
7.	D. Tse and P. Viswanath, "Fundamentals of Wireless Communications," Cambridge Univ Press, 2005

NPTEL / MOOCs:

SL. No	Contents
1.	https://nptel.ac.in/courses/106/105/106105160/
2.	http://www.nptelvideos.in/2012/12/wireless-communication.html

Course Outcomes:

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

CO1	Explain the concepts of wireless and sensor networks.	-
CO2	Apply the knowledge of various technologies, frameworks, applications and trends in wireless and sensor networks.	PO1(3)
CO3	Analyse the given network and arrive at a suitable solution for a given wireless or sensor network scenario.	PO2(2)
CO4	Work in a team, prepare a video to demonstrate the design of a use case using wireless technologies interfacing with relevant sensors.	PO3(2), PO11(2), PO9(1).



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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – II

COURSE TITLE	AGILE METHODOLOGIES AND DEVOPS	Credits	4
COURSE CODE	20MCA2PEAD	L-T-P	3-1-0
CIE	40	SEE	60

Prerequisites: 20MCA1PCSE

UNIT 1:

Introduction

What is Agile? The history of Agile, The Agile Manifesto. The Foundations of Agile: The Agile Mindset, Delivery environment and Agile suitability, the life cycle of product development, The iron Triangle, Working with uncertainty and volatility, Empirical and defined processes. Agile myths. Why Agile? – Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility. How to Be Agile – Agile Methods, Don't Make your own Method, The Road to Mastery, Find a Mentor. Agile in a Nutshell: Deliver Something of Value Every Week, How Does Agile Planning Work? Done means Done, Three Simple Truths. Meet your Agile Team: How are Agile Projects Different? What makes an Agile Team Tick, Roles We Typically See, Tips for Forming Your Agile team.

(7 Hours)

UNIT 2:

Agile Design and Frameworks

Symptoms of Poor Design, Principles, Smells and Principles, what is Agile Design? What Goes Wrong with Software? How did the Agile Developers Know What to Do? Keeping the Design As Good As It Can Be. A Generic Agile Framework: Generic Agile Process, Common Agile Roles: The Customer, The Team, The Agile Lead, The Stakeholders. Major Agile Frameworks: Dynamic system development method(DSDM), Agile Project Management, Kanban, Lean Software Development, Lean Start-up, Scaled Agile Framework (SAFe).

(7 Hours)

UNIT 3:

Agile Development

Agile Practices – The Agile Alliance, Principles. Overview of Extreme Programming: Practices, Customer Team Member, User Stories, Short Cycles, Pair Programming, Collective Ownership, Continuous Integration, The Planning Game, Simple Design. Planning: Initial Exploration, Release Planning, Iteration Planning, Task Planning, Iterating. Testing: Test Driven Development (TDD), Acceptance tests, Exploratory testing. Refactoring. Developing: Incremental requirement. **(7 Hours)**

UNIT 4:

Mastering Scrum

Introduction: What is Scrum? Scrum origins, Why Scrum? Get Ready For Scrum: Scrum is Different, Self-Organization, Incremental product Delivery. Scrum practices: The Scrum Master, product Backlog, Scrum Teams, Daily Scrum Meetings, Sprints, Sprint Planning Meeting, Sprint Review. Applying Scrum: Implementing Scrum, Business value through Collaboration, Empirical Management, managing a Sprint, Managing a release. Why Scrum? Noisy Life, Noise in System Development Projects, Why Current System Development Methodologies Don't Work? Why Does Scrum Works? Advanced Scrum Applications: Applying Scrum to Multiple Related Projects, Applying Scrum to Larger projects, Scrum Values: Commitment, Focus, Openness, Respect, and Courage. Scrum Roles: Product Owner, Scrum Master, Development Team, Manager **(8 Hours)**

UNIT 5:

DevOps

What Is DevOps? History of DevOps, Foundational terminology and Concepts: Software Development Methodologies, Operations Methodologies, System Methodologies, Development, Release, and Deployment Concepts, Infrastructure Concepts, Cultural Concepts. **(7 Hours)**

Text Books:

Sl. No.	Content
1.	Agile Software Development: Principles, Patterns, and Practices, Robert C. Martin with contributions by James W. Newkirk and Robert S. Koss, Pearson Education.
2.	Agile Foundations: Principles, Practices and frameworks, Peter Measey and Radtack, Viva Books Private Limited.
3.	Agile Software Development with Scrum, Ken Schwaber and Mike Beedle, Pearson Indian Edition.
4.	Effective DevOps, Building a Culture of Collaboration, Affinity, and Tooling at Scale, Jennifer Davis and Katherine Daniels, O'Reilly

Reference Books:

Sl. No.	Content
1.	The Agile Samurai, How Agile Masters Deliver Great Software, Jonathan Rasmusson, Shroff Publishers & Distributors Pvt. Ltd.
2.	Essential Scrum, A Practical Guide to the Most Popular Agile Process

Course Outcomes:

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

CO1	Explain the managing of agile environment with the structured organization approach	--
CO2	Apply Agile principles and specific practices to develop/Manage the applications	PO1(3)
CO3	Analyse existing problems of the system with the team, development process and wider organization	PO2(2)
CO4	Identify the risks and rewards associated with agile software engineering.	PO3(1)



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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – II

COURSE TITLE	ADVANCED WEB PROGRAMMING	Credits	4
COURSE CODE	20MCA2PEAW	L-T-P	3-1-0
CIE	40	SEE	60

Prerequisites: 20MCA1PCWT

Unit 1

Introduction to React

Welcome to React: Obstacles and Roadblocks, React's future, keeping up with the changes, working with the files. Emerging JavaScript: Declaring variables, Arrow functions, Transpiling ES6, ES6 Objects and Arrays, Promises, Classes, ES6 Modules and CommonJS

Functional Programming with JavaScript

What it means to be functional, imperative versus declarative, Functional Concepts.

(7 Hours)

Unit 2

Pure React and React with JSX

Pure React: Page Setup, The Virtual DOM, React Elements, React DOM, Children, Constructing elements with data, React Components, DOM Rendering, Factories.

React with JSX: React Elements as JSX, Babel, Recipes as JSX, and Introduction to Webpack.

(7 Hours)

Unit 3

Introduction to Node.js

Node.js Up and Running: Setting up a Node Development Environment, Installing Node on Linux (Ubuntu), Setting up WebMatrix on Window 7, Updating Node. Node: Jumping In, Asynchronous functions and the Node event loop, Benefits of Node.

Interactive Node with REPL and Node Core: REPL- The first look and undefined expressions, benefits of REPL, Multiline and More Complex JavaScript.

Globals, global, process and buffer. The Timers, Servers, streams and sockets, child process.

Routing Traffic, Serving Files and Middleware: Building a Simple Static File Server from Scratch, Middleware, Routers and Proxies. **(8 Hours)**

Unit 4

The Express Framework:

Introduction, Express: Up and running, the app.js file more in detail, Error Handling, a close look at the expression/ connect partnership. Cue the MVC, testing the express applications.

Express framework overview, installing, simple example, handling request and response, routing and server static files, handling GET and POST method, file upload. **(7 Hours)**

Unit 5

Introduction to unstructured databases: NoSQL and MongoDB

Getting started with NoSQL: What it is and why you need it? Definition, Sorted Ordered Column-Oriented Stores, Key/Value stores, Document Databases, Graph Databases. First Impressions- Examining Two Simple examples, working with language bindings.

Introduction to MongoDB: Ease of Use, Easy of Scaling, Tons of features. Documents, Collections, Databases, Data Types, Using MongoDB Shell. Creating, Updating, Deleting and Querying Documents: Inserting, removing, and updating the documents. Querying the document: Query criteria, Type-specific queries, Cursors, database commands. **(7 Hours)**

Text Books:

Sl. No	Contents
1.	Alex Banks & Eve Porcello, “Learning React: Functional Web Development with React and Redux, O’Reilly, July 2018.
2.	Shelly Powers, “Learning Node”, O’Reilly, 2012.
3.	Kristina Chodorow, “MongoDB: The Definitive Guide”, O’Reilly, July 2015.
4.	Shashank Tiwari, “Professional NoSQL”, Wiley, India Pvt. Ltd., July 2015.

E-links

Sl. No	Contents
1.	https://reactjs.org/tutorial/tutorial.html
2.	https://www.tutorialspoint.com/reactjs/
3.	https://www.w3schools.com/nodejs/nodejs_intro.asp
4.	https://www.tutorialspoint.com/nodejs/nodejs_introduction.htm
5.	https://code.tutsplus.com/tutorials/nodejs-for-beginners--net-26314
6.	https://github.com/maxogden/art-of-node/#the-art-of-node
7.	https://www.tutorialspoint.com/mongodb/
8.	https://www.tutorialspoint.com/nodejs/nodejs_express_framework.htm

Course Outcomes:

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

CO1	Describe the concepts of interactive user interfaces, server side frameworks and unstructured database	--
CO2	Apply the knowledge of React.js, Node.js and MongoDB for a given scenario	PO1(3)
CO3	Analyze the user interface, server side and unstructured database components required for a given scenario.	PO2(2)
CO4	Work in team to design and develop an application using the Reat.js, Node.js and MongoDB for a real world problem	PO3(2), PO4(2), PO11(2)



B. M. S. COLLEGE OF ENGINEERING BENGALURU-19
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DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – II

COURSE TITLE	EXTRA/CO-CURRICULAR ACTIVITIES	Credits	Non Credited Course
COURSE CODE	20MCA2NCA2	L-T-P	0-0-0
CIE	-	SEE	-

Rules and regulations:

Students are expected to participate in atleast 3 intercollegiate competitions- Hackathons, Extra/Co-curricular competitions.

Student must produce the hardcopy of the participation certificates (minimum three certificates - 1 Hackathon and 2 Extra/Co-curricular activities) to the faculty coordinator.

This course does not have any CIE or SEE; however, student must produce the participation certificates. The result is declared either pass or fail, based on the completion of the course in the stipulated time.

Expected Course Outcome:

At the end of this course students will be able:

CO1:	Work effectively to engage in a lifelong learning	PO7 (3)
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B. M. S. COLLEGE OF ENGINEERING BENGALURU-19
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Department of Computer Applications
SEMESTER –III

COURSE TITLE	Software Project Management	Credits	3
COURSE CODE	20MCA3HSSM	L-T-P	2-1-0
CIE	40	SEE	60

Prerequisites: 20MCA1PCSE - Software Engineering

UNIT 1:

Introduction to Software Project Management: Introduction, Why is Software project management important? What is a Project? Contract management and Technical project management, Activities in SPM, Plans, methods, and Methodologies, Categorizing projects, Stakeholders, Setting, Objectives, The business case, Project success and failure, What is management? Management control, Traditional versus Modern Project management.

(4 hours)

UNIT 2:

Project evaluation: Evaluation of Individual Projects, Cost Benefit Evaluation Techniques, Risk Evaluation, Programme Management, Managing allocation of Resources within Programmes, Evaluation of individual projects, Cost-benefit evaluation techniques

(5 hours)

UNIT 3:

Activity planning: Objectives of Activity Planning, When to Plan, Project Schedules, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass – Backward Pass, identifying critical path, Activity Float, Shortening Project Duration, Activity on Arrow Networks

(5 hours)

UNIT 4:

Risk management: A framework for dealing with risk, Risk identification, Risk assessment, Risk planning, Risk management, evaluating risks to the schedule, Applying the PERT technique

Monitoring and control: Introduction, Creating the framework, Collecting the data, visualizing progress, Cost monitoring, earned value analysis, prioritizing monitoring, Getting the project back to target.

(5 Hours)

UNIT 5:

Managing people in software environments: Introduction, understanding behaviour, Organization behaviour: a background, Selecting the right person for the job, Instruction in the best methods, Motivation, The Oldham–Hackman job characteristics model

Working in teams: Introduction, becoming a team, Decision making, Organizational structures, Coordination, dependencies, Dispersed and virtual teams, Communication genres, Communication plans, Leadership.

(5 Hours)

Text Book:

Sl. No.	Content
1.	Bob Hughes, Mike Cotterell, and Rajib Mall, Software project management, 6 th edition, McGraw Hill Education (India) Pvt. Ltd., 2017

Reference Books:

Sl. No.	Content
1.	A Guide to the Project Management Body of Knowledge (PMBOK® Guide), Project Management Institute; 6th edition, 2017
2.	Applied Software Project Management, Andrew Stellman and Jennifer Greene Beijing, O’rielly Publications

Online Courses:

Sl. No.	Content
1.	https://nptel.ac.in/courses/106/105/106105218/
2.	https://nptel.ac.in/courses/110/107/110107081/
3.	https://nptel.ac.in/courses/110/104/110104073/

Course Outcomes:

CO1:	Explain the concepts related to Software project management.	-
CO2:	Apply the principles of Software project management.	PO8(3)
CO3:	Develop artifacts related to project management in a team.	PO8(3), PO11(1)



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Department of Computer Applications
SEMESTER –III

COURSE TITLE	Internet of Things	Credits	4
COURSE CODE	20MCA3PCIT	L-T-P	2-0-2
CIE	40	SEE	60

Prerequisites: 20MCA1PCCN – Computer Networks.

UNIT 1

Introduction to IoT:

Definition, Characteristics, Applications, Connectivity Layers, Addressing, Networking, Sensors and Transducers, Actuation and Basics of Networking. Illustrating the Device-to-Device/Machine-to-Machine Integration concepts. Explaining the concept of Device-to-Cloud (D2C) integration, The emergence of the IoT platform as a service. The key application domains

(5 Hours)

UNIT 2

Realization of IoT Ecosystem using Wireless Technologies:

Wireless Sensor Networks, Nodes, Node behaviour, Social Sensing, Applications, Target Tracking, Wireless Multimedia Sensor Networks, Unmanned Aerial Vehicle networks (UAV), Interoperability in Internet of Things, Communication Protocols, Machine-to-Machine Communications, Mobile technologies for supporting IoT Ecosystem, Energy harvesting for power conversion in the IoT system, Mobile Use case for IoT, LPWAN and LoRa

(5 Hours)

UNIT 3

Infrastructure and Service Discovery Protocols for the IoT Ecosystem:

Layered Architecture of IoT, Protocol Architecture of IoT, MQTT, Secure MQTT, CoAP, XMPP, AMQP (Advanced Message Queuing Protocol), IEEE 802.15.4, ZigBee, 6LoWPAN, RFID, HART, NFC, Bluetooth, Zwave. Device or service discovery for IoT

(5 Hours)

UNIT 4

The Integration technologies and tools for IoT Environments:

IoT communication protocol requirements, sensor and actuator networks, The

IoT device Integration concepts, standards and implementation, The protocol and landscape of IoT. **(4 Hours)**

UNIT 5:

The Enablement platforms for IoT applications and Analytics:

IoT: Use Case- Smart Cities, Smart Homes, Connected Vehicles, Smart Grid, Agriculture, Healthcare, Activity Monitoring. IoT data Virtualization and Visualization platforms.

(5 Hours)

Lab:

PART –A:

1. Introduction to Arduino Platform, Programming with Simulators.
2. Integration of Sensors and Actuators with Arduino.
3. Introduction to Visualization and Virtualization tool using Sensor data.

PART –B:

Student has to develop a working IoT Prototype in one of the following Areas: Smart Cities, Smart Homes, Connected Vehicles, Smart Grid, Agriculture, Healthcare, Activity Monitoring.

Text Book:

Sl. No.	Content
1.	The Internet of Things: “Enabling Technologies, Platforms, and Use Cases”, by Pethuru Raj and Anupama C. Raman (CRC Press), 2017.
2.	“Internet of Things: A Hands-on Approach”, by Arshdeep Bahga and Vijay Madisetti (Universities Press). 2014.

Reference Books:

Sl. No.	Content
1.	“Arduino Project Handbook”, Volume 2: 25 Simple Electronics Projects for Beginners by Mark Geddes, 2017.
2.	“Internet of Things (IoT): Systems and Applications” by Jamil Y. Khan, Memhm et R. Yuce, (CRC Press), 2019.

Online Courses:

Sl. No.	Content
1.	https://nptel.ac.in/courses/106/105/106105166/
2.	https://www.coursera.org/specializations/iot
3.	https://www.coursera.org/specializations/uiuc-iot

Course Outcomes:

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

CO1:	Explain the concepts of Internet of Things (IoT).	-
CO2:	Apply the knowledge of IoT to a given scenario.	PO1(3)
CO3:	Implement the concepts of IoT for a given specific problem.	PO4(1), PO5(2)
CO4:	Work in a team, to design and develop IoT prototype for a real-world scenario.	PO3(3), PO11(1)



B. M. S. COLLEGE OF ENGINEERING BENGALURU-19
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Department of Computer Applications
SEMESTER –III

COURSE TITLE	Mobile Application Development	Credits	4
COURSE CODE	20MCA3PCMA	L-T-P	2-0-2
CIE	40	SEE	60

Prerequisites: None

UNIT 1:

Beginning Hybrid Mobile Application Development:

Introduction to Mobile Application Development Ecosystems: History of Mobile Application Development, Understanding Ecosystems, Web Sites and Web Views for Mobile Devices, Adding JavaScript to the Mix, Hybrid Application Framework, Mobile Application Testing. Native vs. Hybrid Mobile Applications: Native Mobile Application Development. Building Blocks of HMAD, How Hybrid Applications Work, Web Applications vs. Hybrid Mobile Applications, Technologies, Frameworks, and Languages. **(4 Hours)**

UNIT 2:

Introduction: Little background to Android:

Android: an open platform for mobile development, native android applications, Android sdk features, why develop for mobile? Why develop for android? Factors Driving Android's Adoption, What Android Has That Other Platforms Don't Have, The Changing Mobile Development Landscape.

Fundamental Android UI Design:

Introduction to Layouts, Indents, Fragments, Views, Widgets, Activities Lifecycle and State, Preferences, and working with file systems, Unit testing and debugging and using support libraries. **(5 Hours)**

UNIT 3:

Expanding the user Experience:

Buttons, images, Input control menus, picker, user navigation, recycle view, Drawables, styles and themes, localization, accessibility, Action Bar, Dialogues, Notifications, Animations, geocoding and location-based services, material design and UI testing. **(5 Hours)**

UNIT 4:

Working Background:

Background task, AsyncTask and Async loader, Internet Connection, Broadcast service, Alarms and Schedulers, Shared preferences, storing data with either SQLite/Room database. Permissions and Security.

(5 Hours)

UNIT 5:

Introduction to Flutter:

Foundations of Flutter programming, learning Dart basics, understanding Widget tree. Intermediate Flutter: Fleshing out an App, Common widget, Animation, App Navigation, Scrolling Lists, Building layouts. Writing platform native code.

(5 Hours)

Tentative Lab Programs:

Part – A

- Programs based on layout, fragments, buttons, Views, and Constraints.
- Programs based on Shared Preferences.
- Programs based on SQLite/Room database.
- Programs based on usage of inbuilt sensors in an application.
- Programs based on geo features for an App.

Part – B

Students should develop a mobile application based on the Capstone project.

Textbook:

Sl. No	Content
1.	Professional Android 4 Application Development: Reto Meier, Wiley Publishing, 2012.
2.	Beginning Hybrid Mobile Application Development: Mahesh Panhale, Apress, 2016.
3.	Beginning Flutter: A Hands On Guide to App Development: Marco L Napoli, Wrox, Published by John Wiley, 2020.

Reference Books:

Sl. No	Content
1.	Pro Android 5: Dave MacLean, Satya Komatineni and Grant Allen, Apress, 2015.
2.	Head First Android Development: A Brain-Friendly Guide: Dawn Griffiths & David Griffiths, O'Reilly Media, 2017
3.	“The Android Developer’s Cookbook: Building Applications with the Android SDK” by James Steele, Nelson To, Addison-Wesley Professional, 2017.

Online Courses:

Sl. No	Content
1.	https://www.udemy.com/course/learn-android-application-development-y/
2.	https://www.coursera.org/learn/aadcapstone
3.	https://www.coursera.org/projects/news-feed-app-flutter
4.	https://www.coursera.org/specializations/android-app-development

Course Outcomes:

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

CO1:	Explain the concepts of mobile application development	-
CO2:	Apply the knowledge of mobile application development to a given scenario.	PO1(3)
CO3:	Work in a team to design and develop mobile applications for a real-world scenario	PO3(3), PO11(1)
CO4:	Implement the concepts of User Interface, controls, shared preferences, and database interactions for different use cases	PO4(1), PO5(2)



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Department of Computer Applications
SEMESTER –III

COURSE TITLE	Mini Project	Credits	3
COURSE CODE	20MCA 3PWMI	L-T-P	0-0-3
CIE	40	SEE	60

Prerequisites: None

Course Details:

1. Students are expected to take up mini project with a team size not exceeding 2*. The objective of this course is to work toward solving problems using latest technologies.
2. The title, relevance, novelty, synopsis and technologies used for developing an application or to carry out research work will be scrutinized by respective guides.
3. The application project / research work may be carried out for the Mini Project.
4. The project must be carried out with a team of TWO students. However during the examination, each student must demonstrate the project individually.
5. The team must submit a brief project report (25-30 pages).
6. The sample contents for both application project or the research project is shown below:

<i>Sample contents for application development include the following chapters:</i>	<i>Sample contents of the Report include the following for Research work:</i>
• Introduction • Project Plan • Software Requirements Specifications (SRS) • Analysis and Design • Implementation (screenshots with description to be included) • Testing • Conclusion • Future enhancements • Bibliography	• Title, Abstract, Keywords • Introduction • Literature Survey • Objectives of Investigation • Research findings (e.g. Proposed method or Process, or System) • Validation (Experimental Results or Theoretical Analysis) • Conclusion & References

Note: * May vary with prior approval from Head of the Department.

Course Outcomes:

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

CO1:	Apply the computing knowledge for the chosen problem domain	PO1(3)
CO2:	Analyse the problem and identify the requirements/objectives	PO2(2)
CO3:	Design and develop a model/process/algorithm	PO3(3)
CO4 :	Conduct required experiments and validate the input and draw valid conclusions	PO4(2)
CO5:	Implement using various software tools/technology	PO5(3)
CO6:	Adhere to ethics during the project development	PO6(1)
CO7:	Function effectively to engage in independent learning	PO7(3)
CO8:	Apply the principles of project management	PO8(2)
CO9:	Work in team, prepare a report and demonstrate the project/paper presentation	PO9(2), PO11(1)



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Department of Computer Applications
SEMESTER –III

COURSE TITLE	Soft Computing	Credits	4
COURSE CODE	20MCA3PESC	L-T-P	3-0-1
CIE	40	SEE	60

Prerequisites: 20MCA1BSMS, 20MCA2PCDS

UNIT 1:

Introduction: Neural Networks, Fuzzy Logic, Genetic Algorithm, Hybrid System, Soft Computing. Artificial Neural Network: Fundamental Concept, Basic Models of Artificial Neural Network, Important Terminologies of ANNs, McCulloch-Pitts Neuron.
(8 Hours)

UNIT 2:

Linear Separability, Hebb Network. Supervised Learning Network: Introduction, Perceptron Networks, Adaptive Linear Neuron, Back-Propagation Network.
(7 Hours)

UNIT 3:

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets: Introduction, Classical Sets, Fuzzy Sets, Properties of Fuzzy Sets, Classical Relations and Fuzzy Relations: Introduction, Cartesian product of Relation, Classical Relation, Fuzzy Relations, Tolerance and Equivalence Relations.
(7 Hours)

UNIT 4:

Membership Functions: Introduction, Features of the Membership Functions, Fuzzification, Methods of Membership Value Assignments. Defuzzification: Introduction, Max membership, Centroid method, weighted average, Mean-max membership, Center of Sums. Fuzzy arithmetic and Fuzzy Measures: Introduction, Interval analysis of Uncertain values, Fuzzy numbers.
(7 Hours)

UNIT 5:

Genetic Algorithm: Introduction, Biological background, Search space, Genetic Algorithm Vs. Traditional Algorithms, Simple GA, General genetic algorithm, Operations in GA: Encoding-Binary, Octal, encoding, Selection-Random, Rank,

Tournament, Crossover: Single-point crossover, Multi-point crossover, Mutation, Stopping condition for Genetic Algorithm Flow, Constraints in Genetic Algorithm
(7 Hours)

List of Lab Programs

Neural Network

- Find Net weight of a multi input neuron & determine whether neuron is fired or not for the given threshold value and Activation Function.
- Hebb's Rule implementation
- Perceptron Training Algorithm implementation

Fuzzy Logic

- Perform primitive operations – Union, Intersection, Complement and Difference on Fuzzy sets
- Perform Cartesian product on given two fuzzy sets.
- Find Lambda cut sets/ relation for the given fuzzy set/relation
- Determine whether the given fuzzy relation is Tolerance or not.

Genetic Algorithm

- Find optimal solution for a given function using genetic algorithm.

Text Books:

Sl. No.	Content
1.	S N Sivanandam, S N Deepa, "Principles of Soft Computing" Second Edition, Wiley Publications, 2017.

Reference Books:

Sl. No.	Content
1.	S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, Fuzzy Systems and Evolutionary Algorithms Synthesis and Applications", Second Edition, PHI Publications, 2017.
2.	Bart Kosko, "Neural Networks and Fuzzy Systems", PHI, 1996.
3.	Timothy J Ross, "Fuzzy Logic with Engineering Applications", Second Edition, Wiley Publications, 2010

Online Courses and E- Books:

Sl. No.	Content
1.	Debasis Samanta, IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc18_cs13/preview

Course Outcomes:

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

CO1	Explain the concepts of soft computing.	-
CO2	Apply soft computing techniques to find solution for a given scenario/problem.	PO1(3)
CO3	Analyse given scenario to develop soft computing model.	PO2(2)
CO4	Develop soft computing model for a given scenario and to draw valid conclusions.	PO3(2), PO4(1)
CO5	Implement Soft Computing techniques to solve a problem using modern tools.	PO5(3)



B. M. S. COLLEGE OF ENGINEERING BENGALURU-19
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Department of Computer Applications
SEMESTER –III

COURSE TITLE	Fog and Edge Computing	Credits	4
COURSE CODE	20MCA3PEFC	L-T-P	3-0-1
CIE	40	SEE	60

Prerequisites: Computer Networks 20MCA1PCCN and basic concepts of IoT.

UNIT 1:

Foundations: Internet of Things (IoT) and New Computing Paradigms: Introduction, Relevant Technologies, Fog and Edge Computing Completing the Cloud, Advantages of FEC: SCALE, Security, Cognition, Agility, Latency, Efficiency,
How FEC Achieves These Advantages: SCANC, Storage, Compute, Acceleration, Networking, Control, Hierarchy of Fog and Edge Computing, Inner-Edge, Middle-Edge, Local Area Network, Cellular Network, outer edge, Constraint Devices, Integrated Devices, IP Gateway Devices, Business Models, X as a Service, Support Service, Application Service.

(7 Hours)

UNIT 2:

Addressing the Challenges in Federating Edge: Introduction, The Networking Challenge, Networking Challenges in a Federated Edge Environment, A Service-Centric Model, Reliability and Service Mobility, Multiple Administrative Domains, Addressing the Networking Challenge, Future Research Directions, The Management Challenge, Management Challenges in a Federated Edge Environment, Discovering Edge Resources, Deploying Services and Applications, Migrating Services across the Edge, Load Balancing, Edge-as-a-Service (EaaS) Platform, Edge Node Resource Management (ENORM) Framework, Future Research Directions, Miscellaneous Challenges, The Research Challenge: Defined Edge Nodes, Unified Architectures to Account for Heterogeneity, Public Usability of Edge Nodes, Interoperability with Communication Networks, Network Slices for Edge Systems, The Modeling Challenge: Computational Resource Modeling, Demand Modeling, Mobility Modeling, Network Modeling, Simulator Efficiency

(7 Hours)

UNIT 3:

Fog Computing: Concepts, Principles and Related Paradigms: Introduction: Fog Computing, Fog Computing Issues: Security and Privacy, Fog Network Topology and Location Awareness of Nodes, Resource Management, Interoperability, Other Issues. Cloud Paradigm Versus Fog Computing: Cloud Computing, Cloud Versus Fog Computing Comparison Fog Computing Versus Edge Computing, Fog Computing Reference Architecture, Fog Computing Application Scenarios, Future of Fog Computing, Fog Computing in the IoT Environment: Principles, Features, and Models: Characteristics, concepts, Models/Architectures: A Generic Fog Computing Architecture, Fog Computing Environmental Model, A Fog Computing Architecture by Joud Khattab, Fog Computing Tree Model.

(7 Hours)

UNIT 4:

Data Management in Fog Computing: Introduction, Background, Fog Data Management, Fog Data Life Cycle: Data Acquisition, Lightweight Processing, Processing and Analysis, Sending Feedback, Command Execution, Data Characteristics, Data Pre- Processing and Analytics: Data Cleaning, Data Fusion, Edge Mining, Data Privacy, Data Storage and Data Placement, e-Health Case Study, Proposed Architecture: Device Layer, Fog Layer, Cloud Layer, Future Research and Direction: Security, Defining the Level of Data Computation and Storage

Fog Computing Realization for Big Data Analytics: Introduction, Big Data Analytics, Benefits, A Typical Big Data Analytics Infrastructure: Big Data Platform, Data Management, Storage, Analytics Core and Functions, Adaptors Presentation, Technologies, Big Data Analytics in the Cloud, In-Memory Analytics, Big Data Analytics Flow, Data Analytics in the Fog: Fog Analytics, Fog-Engines, Data Analytics Using Fog-Engines, Prototypes and Evaluation, Architecture.

(7 Hours)

UNIT 5:

Using Machine Learning for Protecting the Security and Privacy of Internet of Things (IoT) Systems: Introduction, Examples of Security and Privacy Issues in IoT, Security Concerns at Different Layers in IoT: Sensing Layer, Network Layer, Service Layer, Interface Layer, Privacy Concerns in IoT Devices: Information Privacy, Categorization of IoT Privacy Issues, IoT Security Breach Deep-Dive: Distributed Denial of Service, (DDoS) Attacks on IoT Devices: Introduction to DDoS, Timeline of Notable DoS Events, Reason for the Recent Success of the DDoS Attacks, Directions for Prevention of Specific Attacks on IoT Devices, Steps to Prevent Attacks on IoT Devices, Background: Brief Overview of Machine

Learning, Frequently Used Machine-Learning Algorithms : Classification, Regression, Clustering, Dimensionality Reduction, Combining Models (Ensemble ML), Artificial Neural Networks, Examples of Machine-Learning Algorithms in IoT, Overview, Examples

Proposal for Effective ML Techniques to Achieve IoT Security: Insights from the Research, Proposals, Machine Learning in Fog Computing: Introduction, Machine Learning for Fog Computing and Security, Examples of Machine Learning in Fog Computing: ML in Fog Computing in Industry, ML in Fog Computing in Retail, Fog Computing for Self-Driving Cars, Machine Learning in Fog Computing Security, Other Machine-Learning Algorithms for Fog Computing, Future Research Directions **(8 Hours)**

Lab programs (Sample):

Implement the concepts using simulators like iFogSim, Ns3, OMNeT++, NetSim etc.

1	Set up an sensor based network for a given real-world scenario
2	Establish a fog network and set the interaction among the nodes
3	Connect a fog network to a mobile device (edge device)
4	Perform the task of application placement / loading or resource scheduling on the fog network

Text Books:

Sl. No.	Content
1.	Fog and Edge Computing – Principles and paradigm Edited by Rajkumar Buyya and Satish Narayana Srirama, Wiley
2.	Fog Computing Concepts, Frameworks and Technologies - Zaigham Mahmood, Springer

Reference Books:

Sl. No.	Content
1.	Fog Computing – Theory and Practice, Assad Abbas, Samee U. Khan, Albert Zomaya, John Wiley and sons, 1 st edition
2.	Fog Computing in the Internet of Things: Intelligence at the Edge, Pasi Liljeberg, Amir M. Rahmani, Axel Jantsch, Jürjo-Sören Preden, Springer

Course Outcomes:

CO1	Explain the concept of edge and fog computing	-
CO2	Apply the knowledge of edge and fog computing to various scenarios	PO1(3)
CO3	Analyse the impact of data management and security issues in the Fog and Edge networks	PO2(1)
CO4	Design and develop a simulated scenario for a Fog and Edge computing use case	P03(2)
CO5	Implement the concepts of Fog and Edge networks using modern simulation tool	PO4(1), PO5(1)



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Department of Computer Applications
SEMESTER –III

COURSE TITLE	Software Testing	Credits	4
COURSE CODE	20MCA3PEST	L-T-P	3-0-1
CIE	40	SEE	60

Prerequisites: 20MCA1PCSE - Software Engineering

UNIT 1:

Introduction: Human Errors and Testing, Software Quality, Requirements, behaviour and correctness, Testing and Debugging, Test Metrics, Types of Testing, Testing and verification, Principles of Testing, Test generation strategies.

A perspective on Testing: Basic Definitions, Test cases, Insides from a Venn diagram, Identifying test cases, Levels of Testing.

Examples: The Triangle Problem, the *NextDate* Function, the Commission Problem;

(7 Hours)

UNIT 2:

Test Generation: Domain partitioning: Introduction, Test selection problem, Equivalence Partitioning, equivalence classes, Equivalence Test cases for Triangle problem.

Boundary Value Testing: Robust Boundary value testing, Worst-case Boundary value testing, special value testing.

Decision table-based testing: Decision tables, Decision table techniques, and Test cases for Triangle problem, Cause and effect graphing .

(7 Hours)

UNIT 3:

Static and Dynamic Testing:

Static Testing: Management review, Technical Review, Peer reviews, Static Analysis, Proof of Correctness.

Dynamic Testing: Introduction, White box Testing, Black box Testing, Strategy for testing

Testing Tools: Introduction, Features of Test tool, Guidelines for selecting a tool, Tools and skills of tester, Static Testing tools, Dynamic Testing tools, Advantages & Disadvantage of using tools, when to use automated test tools, Testing using automated tools,

Test Planning: Introduction, Test policy, Test Planning, Test plan, Test plan template, Guidelines for developing the test plan, Test Estimation, Test standards, Building test cases, Test scenarios, Test cases, Essential activities in testing, Template for test cases.

(7 Hours)

UNIT 4:

Path Testing: DD Paths, Test Coverage Metrics, Basic path testing.

Integration Testing: Decomposition-Based Integration, Path-Based Integration.

Test Metrics and Test Reports: Introduction, testing related data, Defect data, Categories of the Product/Project test Metrics, Estimated Budgeted approval and actual, Resources consumed in Testing, Effectiveness of Testing, Defect Density, Defect Leakage Ratio, Test Team Efficiency, Test case Efficiency, Rework, MTBF/MTTR, Implementing Measurement Reporting system in an Organization, Test Reports, Project, Integrated Test Report, System Test Report, Acceptance Test Report.

(7 Hours)

UNIT 5:

Introducing WebDrivers and WebElements: Selenium Testing tools, setting up a project in Eclipse with Maven and TestNG using Java WebElements, Locating WebElements using WebDriver, Interacting with WebElements.

Using Java8 features with Selenium: Using Stream API with selenium WebDriver.

Exploring features of WebDriver:

(8 Hours)

Text Books:

Sl. No.	Content
1.	Aditya P Mathur, “Foundations of Software Testing 2E”, Pearson Publications
2.	Software Testing Principles, Techniques and Tools by M.G. LIMAYE, Tata McGraw- Hill Publication
3.	Paul C. Jorgensen,” Software Testing: A Craftsman's Approach”, 4 th Edition, CRC Press
4.	Unmesh Gunecha ,“Learn Selenium”, , 2019, PACKT Publishing. https://store.tutorialspoint.com/ebook_sample_view.php?ebook=learn_selenium

Reference Books:

Sl. No.	Content
1.	Mauro Pezze, Michael Young, “Software testing and Analysis – Process, Principles and Techniques”, Wiley India, 2012.
2.	Software Testing Principles and Practice by Srinivasan Desikan, Gopalaswamy Ramesh, Pearson Education
3.	Software Testing concepts and Tools by Nageshwar Rao pusuluri, Greentech Press.

Lab Programs:

Write and execute test cases for different scenarios using Selenium automation tool.

Course Outcomes:

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

CO1:	Explain the concepts of Software testing	-
CO2:.	Apply software testing techniques for a given problem	PO1(3)
CO3:	Design and Execute test plan & test cases for a given problem.	PO3(2), PO5(1)
CO4:	Perform in a team to prepare a test report for a given scenario.	PO9(1), PO11(1)



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Department of Computer Applications
SEMESTER –III

COURSE TITLE	.Net Programming	Credits	4
COURSE CODE	20MCA3PENT	L-T-P	3-0-1
CIE	40	SEE	60

Prerequisites: None

UNIT 1:

Introduction: .NET Framework, CLR, MSIL, CLS, The Common Language Implementation, Common Type System, Assemblies, Garbage Collection, Exploring Visual Studio IDE C# Fundamentals – Identifiers and Keywords, Variables and Constants – Value Types, Reference Types, Pointer Types, Type Conversions, Boxing and Unboxing, Expressions and Operators, Control Flow Statements, Arrays, Exploring Namespaces, Constructors and Destructors, Method/Function Overloading, Exploring Classes and Objects, Modifiers, Properties, Indexers and Exploring Structs

(7 Hours)

UNIT 2:

Object-Oriented Programming: Encapsulation, Inheritance- Inheritance under constructors, Sealed Classes and Sealed Methods, Extension Methods, Polymorphism- Overloading, Overriding Abstraction- Abstract Classes, Abstract Methods, Exception Handling, Interfaces- Syntax of Interfaces, Implementation of Interfaces, Interfaces and Inheritance. Delegates – Creating and using Delegates, Multicasting with Delegates, Events- Event Sources, Event Handlers, Event and Delegates, System.collections, Generics

(7 Hours)

UNIT 3:

Graphical User Interfaces with Windows Forms: Windows Forms, Benefits of Windows Forms, Exploring Windows Forms, Creating Windows Forms Applications using IDE, Labels, TextBoxes and Buttons, GroupBoxes and

Panels, CheckBoxes and Panels, CheckBoxes and RadioButtons, ToolTips, NumericUpDown Control, Mouse-Event Handling, Keyboard-Event Handling, Menus, MonthCalendar Control, DateTimePicker Control, LinkLabel Control, ListBox Control, CheckedListBox Control, ComboBox Control, TreeView Control, ListView Control, TabControl Control, Multiple Document Interface (MDI) Windows. **(8 Hours)**

UNIT 4:

Data Access with ADO.NET: Understanding ADO.NET- Benefits of ADO.NET, Describing the Architecture of ADO.NET, ADO.NET Entity Framework, ADO.NET compared to Classic ADO, Connected Data Access, Disconnected Data Access without IDE, Creating a Connection to a Database-SQL Server Database, OLEDB Database, ODBC Data Source, Creating a Command Object, Working with DataAdapter, Introducing Data Source Controls, Adding Multiple Tables to a DataSet, Creating DataView, Using DataReader work with Databases. Language Integrated Query (LINQ) **(7 Hours)**

UNIT 5:

ASP.NET Essentials: Describing the ASP.NET Technologies – MVC Framework, ADO.NET Entity Framework, ADO.NET Data Services Framework, The Silverlight Technology, Dynamic Data Framework, ASP.NET Web API, Describing the ASP.NET Life Cycle- Life Cycle of an ASP.NET Application on IIS 7.5, Life Cycle of an ASP.NET web page, creating a sample ASP.NET 4.5 Web Application, Creating a sample ASP.NET 4.5 Web Site. Working with Controls, Validation Controls – The BaseValidator Class, The RequiredFieldValidator Control, The Range Validator Control, The RegularExpressionValidator Control, The CompareValidator Control, CustomValidator Control. The ValidationSummary Control. **(7 Hours)**

Text Books:

Sl. No.	Content
1.	.NET 4.5 Programming (6-in-1), BlackBook, Kogent Learning Technologies, dreamtech Pre 2016.
2.	Paul Deitel and Harvey M. Dietel C# 2012 for Programmers, Deitel Developer Series, 2013.

Reference Books:

Sl. No.	Content
1.	Pradeep Tapadiya, .NET Programming: A Practical Guide Using C# (Hewlett-Packard Professional Books), 2015
2.	Herbert Schildt: The Complete Reference C# 4.0, Tata McGraw Hill, 2017.
3.	E. Balagurusamy: Programming in C#, Tata McGraw Hill, 4th Edition, 2017.

List of lab Programs integrated with Windows Application Development with C#.NET

Part-A

1. Programs to demonstrate Boxing and Unboxing.
2. Program to demonstrate the sum of all the elements present in a jagged array of 3 inner arrays.
3. Programs to demonstrate Classes and Objects.
4. Programs to illustrate the use of different properties in C#
5. Programs to demonstrate Exploring Structs.
6. Programs to demonstrate Exception Handling.
7. Program to demonstrate inheritance covering the concepts of Sealed Classes, Sealed Methods, Extension Methods
8. Programs to demonstrate Abstract Classes and Interfaces.
9. Programs to demonstrate Polymorphism covering the concepts of Overloading, Overriding, Virtual and Override keywords
10. Programs to demonstrate on Operator Overloading.
11. Programs to demonstrate Delegates and Event Handlers.
12. Programs to demonstrate on System collections.

Part-B

13. Build an application using Windows Programming and Database connectivity with ADO.NET.
14. Build an application using ASP.NET techniques with appropriate validations and Database connectivity with ADO.NET

Course Outcomes:

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

CO1	Describe the important features of .NET framework.	--
CO2	Apply the object-oriented Concepts to develop interactive C# applications.	PO1(3)
CO3	Design and develop web-based applications using C# and ASP.NET for a given scenario.	PO3(2), PO11(1)
CO4	Implement programs in C# and ASP.Net using any database software for real-world use cases.	PO4(1), PO5(1)



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Department of Computer Applications
SEMESTER –III

COURSE TITLE	Augmented Reality and Virtual Reality	Credits	4
COURSE CODE	20MCA3PEAV	L-T-P	3-0-1
CIE	40	SEE	60

Prerequisites: 20MCA1BSMS, 20MCA2PCDS

UNIT 1:

Introduction to Augmented Reality - Part 1: History of AR, AR Scenarios, the future of AR, Applications of AR. Calibration and Registration: Transformations, Coordinate Systems.

(8 Hours)

UNIT 2:

Introduction to Augmented Reality - Part 2: Projections, Image formation in a pinhole camera, camera calibration, camera calibration techniques, camera calibration tools.

(7 Hours)

UNIT 3:

Pose Estimation and Tracking: Pose Estimation; Pose Tracking in AR, Classification of Tracking, Stationary Tracking Systems, Mobile Sensor-Based Tracking, Optical Tracking, Hybrid Tracking, Marker-Based Tracking and AR, Diminished Reality, Markerless Tracking and AR.

(7 Hours)

UNIT 4:

Computer Vision for AR: Image Processing, Computer Vision-Definition and Scope, Object Detection and Tracking, Spatial Mapping, 3D Reconstruction for outdoor Tracking, OCR and Text Recognition for AR.

(7 Hours)

UNIT 5:

3D Graphics in AR: Basics of 3D Computer Graphics, 3D Rendering for C++ & C# Developers, 3D Model Importers/loaders, 3D Modeling Software, Graphics Libraries, Graphics Library Dependencies for AR, Graphics Dependency on AR Application Performance, OpenCV and OpenGL to Create AR.

(7 Hours)

Lab Programs

Part-A

- Drawing 2D geometric objects to understand Computer Graphics coordinate system.
- 2D Transformations
- Lighting and Shading effects
- Projections
- 3D object creation & Camera Calibration

Part-B

- Develop AR/VR Application using a modern tool.

Text Books:

Sl. No.	Content
1.	Chetankumar G Shetty, “ <i>Augmented Reality: Theory, Design and Development</i> ”, McGrawHill Publications 2020.

Reference Books:

Sl. No.	Content
1.	Jonathan Linowes, <u>Krystian Babilinski</u> , “Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit and Vuforia”, Paperback – Import, Packt Publishing Limited, 9 October 2017.
2.	Schmalstieg/Hollerer, “Augmented Reality: Principles & Practice”, Paperback–12, Pearson Education India, October 2016.
3.	Chitra Lele, “Artificial Intelligence Meets Augmented Reality: Redefining Regular Reality”, Paperback – 1, BPB Publications, January 2019.

Online Courses and E- Books:

Sl. No.	Content
1.	NPTEL Course on Virtual Reality by Prof Steven LaValle, IIT Madras, https://nptel.ac.in/courses/106/106/106106138/
2.	NPTEL Course on Virtual Reality Engineering by Prof.M Manivannan, IIT Madras, https://nptel.ac.in/courses/121/106/121106013/
3.	NPTEL Course on Introduction to Computer Graphics by Prof. Prem K Kalra, IIT Delhi, https://nptel.ac.in/courses/106/102/106102065/
4.	NPTEL Course on Computer Graphics by Prof. Sukhendu Das, IIT Madras, https://nptel.ac.in/courses/106/106/106106090/
5.	NPTEL Course on Computer Graphics by Prof. Samit Bhattacharya, IIT Guwahati, https://nptel.ac.in/courses/106/103/106103224/

Course Outcomes: At the end of the course, student will be able to:

CO1	Explain basic concepts of computer graphics/ AR/ VR	-
CO2	Apply the concepts of computer graphics/AR to build and process the 2D/3D models.	PO1(3)
CO3	Write a program using modern tools to create and process 2D/3D models	PO5(3)
CO4	Develop AR/VR application in a team.	PO3(1), PO11(1)



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SEMESTER –III

COURSE TITLE	Social Network Analysis	Credits	4
COURSE CODE	20MCA3PESN	L-T-P	3-0-1
CIE	40	SEE	60

Prerequisites: Computer Networks: 20MCA1PCCN

UNIT 1:

Towards Trans disciplinary Collaboration between Computer and Social Scientists: Initial Experiences and Reflections:

Introduction: Reflections on Computational Social Science, Context: “Space for Sharing” ESRC Project, Digital Outreach and Emotional Distress: Balancing What Is Possible with What Is Meaningful, Small Data in Big Data, Finding the Everyday, Trust and Empathy Online during Disasters and Humanitarian Crisis: Role of Social Media, Measuring Empathy and Trust, Social Network Analysis and Sentiment Exchange: Data Collection, Friends in Need Are Friends Indeed: Effect of Social Network, Interactions on Twitter Users in Emotional Distress, One- to-One Conversation versus Group Discussions, Metadiscussion on the Nature of Collaboration between Computer and Social Sciences, Attaching Meaning to Data and Attendant Ethical Concerns: Being Lost or Found in Big Data, Systems Approaches Facilitating Interdisciplinary Research, Learning through Doing: The Nature of Social and Computer Science Collaboration

(7 Hours)

UNIT 2:

How Much Sharing Is Enough? Cognitive Patterns in Building Interdisciplinary Collaborations: Interdisciplinary Collaboration: A Dynamic Social Networking, Research Question, Typologies for IC and Knowledge Sharing Theories: Types of IC, Problems of Knowledge Sharing in IC, Models for Successful IC in Teams, Methods to Investigate IC in Scientific Teams, Case Studies on an IC Project: The CSP Project: Case 1: Sociology and Physics, Case 2: Social Psychology and Computer Science, Case 3: Social Psychology, Physics, and Computer Science, Differences between Two Kinds of IC Methodological Procedures, Collaborative Patterns.

(7 Hours)

UNIT 3:

Patterns of Group Movement on a Virtual Playfield: Empirical and Simulation Approaches: Group Movements in Animals and Humans, Coordination Processes and Mechanisms for Group Movement, HoneyComb©: An Experimental Paradigm for Measuring, Coordination and Leadership in Group movement, Empirical and Simulation Approaches to Collective Movement, Empirical, approach: First Swarming Parameter: Cohesion (Study 1), Stability of Cohesion (Study 2), Second Swarming Parameter: Alignment (Study 3), Leadership in Group Movement: Optimal Strategies Programmed Leaders (Study 4) Computer Simulation Approach: Introduction, General Concepts, Group-Cohesion Mobility Model, simulation Results, Comparison of Empirical and Simulation Results, Discussion

(7 Hours)

UNIT 4:

Social Spammer and Spam Message Detection in an Online Social Network: A Codetection Approach: Social Spammer and Spam Message Detection: Background and Motivation, Social Spammer Detection, Spam Message Detection, Social Spammer and Spam Message Codetection, Social Context Extraction: User–Message Relation, User–User Relation, Message–Message Relation, Social Spammer and Spam Message Codetection: Notations, Model, Optimization Method, Updating x, Updating y, Experimental Evaluation: Dataset, Model Comparison, Performance Evaluation, Influence of Classifier Type, Conclusion

(7 Hours)

UNIT 5:

Information Dissemination in Social-Featured Opportunistic Networks: Introduction, Model, Social Features: Social Profiles, Social Network Structures, Unicast: Distributed Community Partitioning, Intracommunity Communication, Intercommunity Communication, Performance Evaluation, Data Sets, Experiment Setup, Impact of Community Numbers, Impact of Community Partitioning Algorithms, Performance Comparison, Multicast: Dynamic Social Features, Multi-CSDO Algorithm, Similarity Weighted Graph and Distance Matrix, Community Detection Algorithm, Destinations Split, Multi-CSDR Algorithm, Performance Evaluation, Simulation Setup, Simulation Results, Conclusion.

(8 Hours)

Lab work:

The students can choose a social network of their choice and analyse it using modern tool.

Text Books:

Sl. No.	Content
1.	Social Network Analysis: Interdisciplinary Approaches and Case Studies Edited by Xiaoming Fu, Jar-Der Luo, Margarete Boos, CRC Press

Reference Books:

Sl. No.	Content
1.	Social Network Analysis for Startups: Finding Connections on the Social Web Book by Alexander Kouznetsov and Maksim Tsveto, Orielly
2.	Understanding Social Networks: Theories, Concepts, and Findings Book by Charles Kadushin, Oxford University Press

Course Outcomes:

CO1:	Explain the concepts of social network analysis	-
CO2:	Apply the knowledge of social network analysis to various scenarios	PO1(3)
CO3:	Analyse a social network for a use case	PO2(1)
CO4:	Design an application for a social network scenario.	PO3(2), PO11(1)
CO5:	Implement the concepts of social network for a given use case using a modern tool	PO4(1), PO5(1)



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SEMESTER –III

COURSE TITLE	Block Chain Technology	Credits	4
COURSE CODE	20MCA3PEBC	L-T-P	3-0-1
CIE	40	SEE	60

Prerequisites: NIL

UNIT 1:

Introduction to Blockchain: Blockchain: An Information Technology, Satoshi Nakamoto's Blockchain, Types of Blockchain Public, Consortium, Private, Comparing Blockchains, Blockchain Implementations – Bitcoin, Ethereum , Blockchain Collaborative Implementations – Hyperledger, Corda, Blockchain in Practical Use Today – Financial Technology space, Sharing Economy, Real Estate, Blockchain and Identity, Practice of Law, Decentralized File Storage, Autonomous Organizations, Cloud Computing.

(7 Hours)

UNIT 2:

Business Use Cases: Currency and Tokens, Financial Services Use Cases – KYC use case, Asset Management Settlement Use Case, Insurance Claims Processing Use Case, Trade Finance (Supply Chain) Use Case, Global Payments Use Case, Smart Property, Smart Contracts on the Blockchain – The Trust Problem, Blockchain Details, Blockchain IoT Protocol Projects.

Technology Use Cases: Web Versions 1 and 2, Web 3.0, Distributed Storage Systems, Distributed Computation, Golem, Decentralized Communications.

(7 Hours)

UNIT 3:

Legal and Governance Use Cases: Blockchain changes the Legal Landscape, The Beginning of Autonomous Law: Smart Contract – Smart Contract Evolution, Smart Contract Components, Benefits, Challenges, Risks, Legal Challenges, Blockchain as Evidence and Digital Signature, Smart Contract Design Examples.

Technology on Ethereum: Ethereum Accounts – Either the crypto currency, Obtaining Ether, Mining in Ethereum, Ethereum Work – Transactions, Network Fuel (Gas), Messages, The Ethereum Block, State Transition Function (STF), Code Execution, Turning Complete, Scalability, Infrastructure Storage and Communication, Decentralized Applications.

(7 Hours)

UNIT 4:

Fast- Track Application Tutorial – Introducing Solidity – Solidity Basics, Solidity Functions and parameters, Layout of Storage, Run Ethereum Dapps in your Browser – Installing MetaMask, Developing a Contract using MetaMask, Remix/Browser Solidity, Develop a Simple Smart Contract – Deploy the Smart Contract, Validate the Smart Contract.

Ethereum Applications Best Practices – Ethereum Block chain Development – Setting up the Development Environment for Truffle, Set Up a Truffle Project, Truffle Directory Structure, Ethereum Blockchain Development: Best Practices, Block chain Technologies, Solidity Basics Continued Calling Contracts from Contracts, Handling Events.

(7 Hours)

UNIT 5:

Private Blockchain Platforms and Use Cases – Categories of Block chain, Private Blockchain Use Cases, Private Blockchain Technology- AlphaPoint Distributed Ledger Platform, Chain Core, Corda, Domus Tower, Hyperledger etc.

Challenges – Blockchain Governance Challenges – Bitcoin Blocksize Debate, The Ethereum DAO Fork, Ethereum's Move to PoS and Scalling Challenges, Blockchain Technical Challenges – Bugs in the Core Code, Denial-of-Service Attacks, Security in smart contracts, scaling, Sharding.

(8 Hours)

Text Books:

Sl. No.	Content
1.	Joseph J. Bambara, Paul R. Allen, Blockchain – A practical Guide to Developing Business, Law, and Technology Solutions, McGraw Hill Education, 2018.

Reference Books:

Sl. No.	Content
1.	Arshdeep Bahga, Vijay Madisetti, Blockchain Applications: A Hands-On Approach January 31, 2017
2.	Imran Bashir, Mastering Block chain: Distributed ledger technology, decentralization and Smart contracts, 2nd Edition, Packt Publishing, 2018.
3.	Narayan Prusty, Building Block chain Projects, Packt Publishing, 2017.
4.	Blockchain and Distributed Ledger Technology Use Cases - Applications and Lessons Learned. Horst Treiblmaier, Trevor Clohessy, Springer 2020.

List of lab programs integrated with Java programming theory:

1. Blockchain and decentralized ledger technology
1. Introduction to the variety of blockchain development environments and then delve in Ethereum.
2. Programming and smart contracts and test blockchain networks.
3. Dapp (decentralized app)
4. Create your own currency and trade using the Metamask wallet with transactions

Course Outcomes:

CO1	Describe the technologies underlying crypto currencies and block chains	--
CO2	Apply the knowledge of Block chain Technology for a given use case.	PO1(2)
CO3	Analyse the given business/ legal/governance use cases of the real world applications.	PO2(1), PO10(1)
CO4	Perform in a team to prepare a report on the impact of Crypto currency on society and governance.	PO5(1), PO9(1), PO11(1)



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SEMESTER –III

COURSE TITLE	Advanced Java Programming	Credits	4
COURSE CODE	20MCA3PEAJ	L-T-P	3-0-1
CIE	40	SEE	60

Prerequisites: 20MCA2PCJP

UNIT 1:

Servlets: Servlet Structure, Servlet packaging, HTML building utilities, Lifecycle, Single Thread model interface, Handling Client Request : Form Data, Handling Client Request: HTTP Request Headers. Generating server Response: HTTP Status codes, Generating server Response: HTTP Response Headers, Handling Cookies, Session Tracking. **(7 Hours)**

UNIT 2:

JSP: Overview of JSP Technology, Need of JSP, Benefits of JSP, Advantages of JSP, Basic syntax, Invoking java code with JSP scripting elements, creating Template Text, Invoking java code from JSP, Limiting java code in J S P, using jsp expressions, comparing servlets and jsp, writing scriptlets. For example Using Scriptlets to make parts of jsp conditional, using declarations, declaration example. Controlling the Structure of generated servlets: the JSP page directive, import attribute, session attribute, isEliignore attribute, buffer and auto flush attributes, info attribute, errorPage and is errorPage attributes, is Thread safe Attribute, extends attribute, language attribute, Including files and applets in jsp Pages, using java beans components in JSP documents. Integrating servlets and JSP: The Model View Controller (MVC) architecture.

(7 Hours)

UNIT 3:

Java Beans and Annotations: Creating Packages, Interfaces, JAR files and Annotations. The core java API package, New java. Lang Sub package, Built-in Annotations. Working with Java Beans. Introspection, Customizers, creating java bean, manifest file, Bean Jar file, new bean, adding controls, Bean properties, Simple properties, Design Pattern events, creating bound properties, Bean Methods, Bean an Icon, Bean info class, Persistence, Java Beans API.

(7 Hours)

UNIT 4:

JDBC: Talking to Database, Immediate Solutions, Essential JDBC program, using prepared Statement Object, Interactive SQL tool. JDBC in Action Result sets, Batch updates, Mapping, Basic JDBC data types, Advanced JDBC data types, immediate solutions.

(7 Hours)

UNIT 5:

Spring Framework: What is spring? Initializing a Spring application, writing a Spring application, Surveying the Spring landscape.

Developing web applications -Displaying information, Processing form submission, Validating form input.

Working with view controllers, Choosing a view template library, Caching templates. Discovering services - Thinking in micro services, Setting up a service registry.

Introducing Actuator - Configuring Actuator's base path, Enabling and disabling Actuator endpoints.

(8 Hours)

Text Books:

Sl. No.	Content
1.	Marty Hall, Larry Brown, "Core Servlets and Java Server Pages", Volume 1: Core Technologies. 2 nd Edition
2.	"Java 8 Programming Black Book", Dreamtech Press, 2012.
3.	Craig Walls, "Spring in Action", 5 th Edition

Reference Books:

Sl. No.	Content
1.	Herbert Schildt, "Java The Complete Reference", Comprehensive Coverage of Java Language, Oracle Press, McGraw Hill Education (India) Edition, 11 th Edition, 2014.
2.	Jim Keogh, "J2EE The Complete Reference", McGraw Hill Education (India) Edition 2002.

List of lab programs integrated with Java programming theory:

1. Programs using Servlets.
2. Programs using JSP.
3. Programs using Javabeans with JSP.
4. Programs using JDBC.
5. Programs using Spring.

Note:

1. Total number of programs up to 12.
2. Programs needs to be executed as per the requirements and expected output.

Course Outcomes:

CO1	Demonstrate an understanding of advanced java programming concepts	--
CO2	Use appropriate technologies in the Java programming language to solve the given problem.	PO1(2)
CO3	Develop an application and deploy it in a suitable environment.	PO5(2)
CO4	Work in team to analyze J2EE based application and make an oral presentation.	PO9(1) PO11(1)



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SEMESTER –III

COURSE TITLE	ENTREPRENEURSHIP and IPR	Credits	3
COURSE CODE	20MCA3HSES	L-T-P	2-1-0
CIE	40	SEE	60

Prerequisites: Nil

UNIT 1:

Entrepreneur: Introduction, Evolution, Characteristics of successful Entrepreneur, Charms of becoming an entrepreneur, functions, need, types, Distinction between an Entrepreneur & a manager, Intrapreneur

Entrepreneurship: Concept, growth of Entrepreneurship in India, Role of Entrepreneurship in Economic Development **(4 Hours)**

UNIT 2:

Women Entrepreneurship: Concept, Functions, Growth, Problems, Developing, Limitation of Women Entrepreneurship.

Rural Entrepreneurship: Meaning, need, problems, developing, NGO & Rural Entrepreneurship.

Agri-prenuership: Introduction, need for developing agri-prenuership in India, Opportunities for developing agri-prenuership, Challenges involved in developing agri-prenuership, suggestions for developing agri-prenuership.

Social Entrepreneurship: Introduction, meaning, perspective, Social Entrepreneurship in practice, boundaries of Social Entrepreneurship

(6 Hours)

UNIT 3:

Micro & Small Enterprise: Small Enterprise: Meaning, Micro & Macro Units, Essentials, Features & Characteristics, Relationship between Micro & Macro Enterprises, Rationale behind Micro & small enterprises, Scope of Micro & small enterprises & objectives of Micro enterprises.

Financing of Enterprise: Meaning & need of financial planning, sources of finance, capitalisation, term loans, sources of short term finance, Venture capital.

Forms of business ownership: Sole proprietorship, partnership, company, cooperative, selection of appropriate form of ownership

(6 Hours)

UNIT 4:

Identification of Business opportunities: Introduction, Mobility of Entrepreneurs, Business opportunities in India, Models for opportunity evaluation.

Project Management and Financing: Introduction, Project Manager, Project Life Cycle, Project Scheduling: GANTT Charts, Network techniques, Project Management software: Microsoft Project, InstaPlan, Yojana, PRISM Project Manager, PRIMAVERA, Generating an investment project proposal: Project Analysis, Market Analysis, Technical Analysis, Financial Analysis, Economic Analysis, Ecological Analysis. Project Financing: Equity Financing, Angel Financing, Debt Financing, Miscellaneous sources. Project Implementation Phase, capital structure and cost of capital, Detailed Project Report.

Business Plan: Introduction, purpose, contents, presenting, why do some plans fail? Procedure for setting up an enterprise.

Institution supporting business enterprises: Introduction, central level institutions, state level institutions, other institutions, Institutions supporting women entrepreneurs

(4 Hours)

UNIT 5:

Intellectual Property Rights and Micro & Small and Medium Enterprise: IPR and MSMEs, Patents: meaning, what can be patented? Types of patent, who can file a patent, patent process. Copyrights: Meaning, objectives. Trademarks: Meaning, functions, categories of trademarks, benefits, registration of trademarks. Geographical indications, Industrial designs, Trade Secrets, Integrated Circuits, protection of new variety of plants, why IPR for MSMEs? Efforts to help MSMEs to exploit benefits of IPR, Need for further actions.

(4 Hours)

Text Books:

Sl. No.	Content
1.	Entrepreneurial Development, Dr S S Khanaka, Revised edition, S Chand Publishing
2.	Entrepreneurship and Small Business Enterprises, Poornima M Charantimath, 2nd Edition, Pearson

Reference Books:

Sl. No.	Content
1.	Desai, Vasant, Project Management and Entrepreneurship', Himalayan Publishing House, Mumbai.
2.	Gupta and Srinivasan, 'Entrepreneurial Development', S Chand & Sons, New Delhi.

Online Courses:

Sl. No.	Content
1.	https://teamtreehouse.com/library/how-to-start-a-business
2.	https://onlinecourses.nptel.ac.in/noc20_hs66/preview
3.	https://onlinecourses.nptel.ac.in/noc19_mg55/preview

Course Outcomes:

CO1.	Explain the concept of Entrepreneurship and IPR.	--
CO2.	Apply the knowledge of entrepreneurship and IPR to various scenarios.	PO12(3)
CO3.	Perform in a team, to prepare a report & make effective oral presentation on topics related to Entrepreneurship.	PO7(1), PO9(3), PO11(1)



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SEMESTER –III

COURSE TITLE	Societal Activity	Credits	Non Credited course
COURSE CODE	20MCA3NCA3	L-T-P	0-0-0
CIE	NA	SEE	NA

Prerequisites: None

Guidelines:

1. The student shall take up a work with an NGO / Professional body / NSS / NCC etc.
2. This course does not have any CIE or SEE; however, the students are required to submit a Completion Certificate to the Department office.
3. The result is declared either pass or fail, based on the completion of the course in the stipulated time.

At the end of this course, students will have the ability to:

CO1:	Engage in independent learning in the chosen area/ field.	PO7(3)
CO2:	Understand the legal, environmental, societal and health issues for the work carried out.	PO10(3)
CO3:	Function effectively as an individual or work in team for the task undertaken during internship	PO11(1)



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Department of Computer Applications
SEMESTER –IV

COURSE TITLE	Major Project	Credits	19
COURSE CODE	20MCA4PWMP	L-T-P	0-0-19
CIE	100	SEE	100

The objective of this course is to work independently to carry out an application oriented or a research oriented project.

Guidelines:

1. The project shall be carried out individually in Industry / R & D lab / Institution.
2. The project shall be carried out for a semester.
3. The student shall identify the domain / area / topic and place of work where the project will be carried well in advance.
4. The student shall submit the synopsis within one week from the commencement of 4th semester.
5. An internal guide will be allotted for each student.
6. Student should interact with the internal guide every week to update the progress of the project.
7. At the end of the semester, project / dissertation report (40-60 pages) is to be submitted.
8. Project report has to undergo a plagiarism check and the plagiarism index has to be $\leq 25\%$.
9. The CIE of the project work will be evaluated by the Guide and Project Evaluation Committee (PEC) member.
10. The student is required to take two CIEs of the project work, as per the schedule, for 50 marks each.
11. The dissertation report will be evaluated by the internal guide and external examiner appointed by the COE for SEE.
12. SEE will be conducted for 100 marks jointly by the internal guide and the external examiner.
13. A seminar presentation, project report evaluation and Viva-Voce shall form the SEE of the project work.

The format of the report shall include the following:

- i) A bonafide certificate duly signed by the Guide (internal and external), Head of the Department and Head of the Institution.
- ii) An undertaking by the student that the work is independently carried out by him/her.
- iii) A project completion certificate from Industry / R & D lab / Institution.
- iv) Acknowledgement.

Sample contents for application development include the following chapters:

- Abstract
- Introduction
- Software Requirements Specifications (SRS)
- Project Plan*
- Analysis
- Design
- Implementation (screenshots with description to be included)
- Testing
- Business Model
- Impact on societal / environmental / health / others.
- Conclusion
- Future enhancements
- Team Work details
- Bibliography

Sample contents for Research work include the following:

- Title, Abstract, Keywords
- Introduction
- Literature Survey
- Project Plan*
- Objectives of Investigation
- Research findings (e.g. proposed method or Process, etc.)
- Validation (Experimental Results or Theoretical Analysis)
- Business Model
- Impact on Society/ environmental / health / others.
- Conclusion and Future enhancements
- Team Work details
- Bibliography

*E.g.: Work breakdown structure, Gantt chart, PERT chart/ CPM.

Details of the Evaluation

- CIE-1 and CIE-II shall be conducted for 50 marks each and SEE will be conducted for 100 marks.

Marks distribution of CIE-1 (50 Marks) - (For Application oriented Projects)

Sl. No	Parameters	Marks	CO mapping
i.	Project Relevance, identification of requirements / objectives of the project, and SRS	12	CO1
ii.	Project Planning	05	CO8
iii.	Analysis	12	CO2
iv.	Design	13	CO3
v.	Presentation of the work (up to design)	08	CO9

Marks distribution of CIE-II (50 Marks) (For Application oriented Projects)

Sl. No	Parameters	Marks	CO mapping
i.	Design of Test plan and test cases	03	CO3
ii.	Validate the Inputs and Drawing valid Conclusions	06	CO4
iii.	Implementation and Usage of Modern tools	12	CO5
iv.	Independent Learning	08	CO7
v.	Business Model	03	CO12
vi.	Impact on society / environment / health and others	04	CO10
vii.	Plagiarism report ($\leq 25\%$)	06	CO6
viii.	Team Work	03	CO11
ix.	Written communication (Report)	05	CO9

Marks distribution of SEE (100 Marks) (For Application oriented Projects)

Project Viva-Voce: 30 Marks

Sl. No	Parameters	Marks	CO mapping
i.	Demonstration of Validation of the Inputs and Drawing valid Conclusions	10	CO4
ii.	Demonstration of project work	14	CO5
iii.	Oral Communication	06	CO9

Report Evaluation: 70 marks

Sl. No	Parameters	Marks	COs
i.	Project Relevance, identification of requirements / objectives of the project and SRS	10	CO1
ii.	Project Planning	05	CO8
iii.	Analysis	10	CO2
iv.	Project Design/ Test plan and Test cases	15	CO3
v.	Independent Learning	06	CO7
vi.	Plagiarism report ($\leq 25\%$)	06	CO6
vii.	Business model	03	CO12
viii.	Team work	03	CO11
ix.	Impact on society / environment / health	04	CO10
x.	Written Communication	08	CO9

MARKS DISTRIBUTION: (For Research Oriented Projects)

Marks distribution of CIE-1 (50 Marks)

Sl. No	Parameters	Marks	CO mapping
i.	Problem Identification / objective of the project	12	CO1
ii.	Project Planning	05	CO8
iii.	Literature Survey	08	CO7
iv.	Analysis	12	CO2
v.	Methodology	05	CO3
vi.	Presentation of the work	08	CO9

Marks distribution of CIE-II (50 Marks) (For Research Oriented Projects)

Sl. No	Parameters	Marks	COs
i.	Design of Algorithms/ process, etc.	10	CO3
ii.	Validate the Inputs and Drawing valid Conclusions	06	CO4
iii.	Implementation and Usage of Modern tools	12	CO5
iv.	Impact on society / environment / health and others	04	CO10
v.	Plagiarism report ($\leq 25\%$)	06	CO6
vi.	Team Work / Individual work	03	CO11
vii.	Business Model	03	CO12
viii.	Written communication(Report)/ Publication	06	CO9

Marks distribution of SEE (100 Marks) (For Research Oriented Projects)

Project Viva-Voce: 30 Marks

Sl. No	Parameters	Marks	CO mapping
i.	Demonstration of Validation of the Inputs and Drawing valid Conclusions	10	CO4
ii.	Demonstration of project work	14	CO5
iii.	Oral Communication	06	CO9

Report Evaluation: 70 marks

i.	Problem Identification / objective of the project	10	CO1
ii.	Project Planning	05	CO8
iii.	Literature Survey	06	CO7
iv.	Analysis	10	CO2
v.	Methodology/ Design of Algorithms/ process etc..	15	CO3
vi.	Impact on society / environment / health and others	04	CO10
vii.	Plagiarism report ($\leq 25\%$)	06	CO6
viii.	Written communication/ Publications	08	CO9
ix.	Business Model	03	CO12
x.	Team Work/ Individual	03	CO11

Course Outcomes

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

CO1:	Apply the computing knowledge for the chosen problem domain	PO1(3)
CO2:	Analyse the problem and identify the requirements / objectives	PO2(3)
CO3:	Design and develop a model / process / algorithm	PO3(3)
CO4:	Conduct required experiments, validate the inputs & draw valid conclusions	PO4(2)
CO5:	Implement using appropriate software tools / technology	PO5(3)
CO6:	Adhere to ethics during the project development	PO6(2)
CO7:	Function effectively to engage in independent learning	PO7(2)
CO8:	Apply the principles of project management	PO8(2)
CO9:	Prepare a report and poster, and demonstrate the project	PO9(3)
CO10:	Identify Legal / Ethical / Society / Health or Environment issues related to project work.	PO10(1)
CO11:	Perform in a team while carrying out a project work.	PO11(1)
CO12:	Generate ideas & identify the business model to convert the project work into a product.	PO12(1)



B. M. S. COLLEGE OF ENGINEERING BENGALURU-19
(Autonomous College under VTU)

Department of Computer Applications
SEMESTER –IV

COURSE TITLE	Internship	Credits	4
COURSE CODE	20MCA4NTIP	L-T-P	0-0-4
CIE	40	SEE	60

Guidelines:

1. Students are required to undergo Internship in an Industry or a R&D Institution, or any academic institution of highly repute.
2. The students are required to submit Internship approval letter from the organization.
3. Students are required to choose an internal guide.
4. The students will be working under the mentorship of both internal and external guide.
5. The duration of Internship is for 6 weeks.
6. The student shall carry out internship any time after the completion of Second semester and before the commencement of fourth semester project.
7. At the end of the internship period, students are required to submit an attendance certificate, Completion Certificate and Internship report.
8. CIE: 40 Marks and SEE: 60 Marks will be conducted.
9. For CIE & SEE, the student should present the work carried out during internship.

Course Outcomes:

At the end of this course, students will have the ability to:

CO1:	Understand the problem with thorough analysis and learn the required tools and technologies to solve the problem	PO2(2), PO5(1)
CO2:	Adhere to Professional/Ethical behaviour while interacting with people in the organization	PO6(2)
CO3:	Function effectively to engage in independent learning	PO7(3)
CO4:	Write a report and communicate effectively	PO9(2)
CO5:	Demonstrate the importance of Legal, Societal, Environmental and Health issues related to Technologies	PO10(3)
CO6:	Work effectively as a member in a team	PO11(2)
CO7:	Identify the Intrapreneur/ Entrepreneur characteristics adopted in the industry	PO12(2)



B. M. S. COLLEGE OF ENGINEERING BENGALURU-19
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Department of Computer Applications
SEMESTER –IV

COURSE TITLE	Seminar (Research Oriented)	Credits	2
COURSE CODE	20MCA4SRSR	L-T-P	0-0-2
CIE	40	SEE	60

Seminar Guidelines:

1. Select a broad area of your interest (E.g. Computer Networks, Machine Learning/Data mining, Databases, etc.)
2. Select a specific area in the broad area chosen. (E.g. in Data mining, one can choose cluster analysis or Classification or Association rule mining). Subsequently you can choose a more narrowed topic like Density based clustering or Grid based clustering, etc.
3. Further search at least 15 recent papers (e.g. last 2-5 years) related to your specific topic in IEEE explore or Science direct or ACM digital library, etc.. From these papers, select best 6 papers, preferably Journal papers or Reputed conferences. (E.g. Machine Learning Journals: IEEE PAMI, Knowledge and Data engg., Elsevier – Pattern recognition, Pattern Recognition Letters, Data and Knowledge engineering, Springer- Pattern Analysis and Applications, Data mining and Knowledge discovery, Reputed conferences- ICPR, CVPR, KDD, ICAPR, etc.)
4. Read these 6 papers thoroughly. For each paper: Write down a summary based on their contributions (ideas), Improvements claimed, Parameters used for comparison, Experiments carried out, Tools used, Limitations, YOUR IDEAS for improving the work proposed, etc.
5. Write a report in the form a research article:

Sample contents:

- Title, Abstract, keywords,
- Introduction,
- Review of the literature (related to 6 papers chosen),
- Comparison of the methods (6 papers) wrt the parameters identified (e.g. classification rate, time complexity, F1 score, etc.)
- Ideas to improve the methods,
- Conclusion,
- References, Plagiarism report.

Course Outcomes:

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

CO1:	Identify the best method among a set of research findings	PO2 (3)
CO2:	Apply professional ethics during preparation of report	PO6(1)
CO3:	Demonstrate life-long learning skills	PO7(2)
CO4:	Demonstrate oral and written communication skills	PO9(3)



B. M. S. COLLEGE OF ENGINEERING BENGALURU-19
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Department of Computer Applications
SEMESTER –IV

COURSE TITLE	Personality Development	Credits	Non Credited & Mandatory Course
COURSE CODE	20MCA4NCA4	L-T-P	0-0-0
CIE	-	SEE	-

Prerequisites: None

Personality Development is a non-technical course facilitate an all-round development of personality. It is essential to enhance soft skills in professional and inter-personal communications. Hard or technical skills help securing a basic position in one's life and career. But only soft skills can ensure a person retain it, climb further, reach a pinnacle, achieve excellence, and derive fulfilment and supreme joy. Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills.

This course covers various dimensions and importance of effective personality. It helps understand personality traits and formation and vital contribution in the world of business. Also, the course makes the students aware about the various dynamics of personality development.

Students can complete MOOC courses pertained to

- significance of soft skills in professional and inter-personal communications
- interpersonal and management skills

Rules and regulations:

This is not a team work; a student has to register and complete the course individually. Students shall take up any online courses (paid/unpaid) or an offline course on one of the topic chosen by them. Student must produce the hardcopy of the registration detail/ send mail to the faculty coordinator about the confirmation details of registration for the course taken up at the beginning of the semester. This course does not have any CIE or SEE; however, student must produce the completion certificate for the course taken up in this semester/period. The result is declared either pass or fail, based on the completion of the course in the stipulated time.

Course Outcome:

At the end of this course students will be able to:

CO1:	Develop effective communication skills	PO7(1)
CO2:	Become self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills.	PO9(1)
CO3:	Develop all-round personalities with a mature outlook to function effectively in different circumstances	PO11(2)