



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
(Established by Govt. of A.P., ACT No.30 of 2008)
KAKINADA – 533 003 (A.P) INDIA
BCA COURSE STRUCTURE AND SYLLABUS
(Applicable for batches admitted from 2024-2025)

COURSE STRUCTURE AND SYLLABUS

For

BACHELOR OF COMPUTER APPLICATIONS (BCA)

(Applicable for batches admitted from 2024-2025)



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA***(Established by Govt. of A.P., ACT No.30 of 2008)***KAKINADA – 533 003 (A.P) INDIA****BCA COURSE STRUCTURE AND SYLLABUS***(Applicable for batches admitted from 2024-2025)***COURSE STRUCTURE**

I Year – I SEMESTER						
S. No	Category	Courses	L	T	P	Credits
1	AEC-1	Communicative English	3	0	0	3
2	VAC	Computer Fundamentals	3	0	0	3
3	MD	Fundamentals of Commerce	2	0	0	2
4	CORE	Digital Logic Design	3	0	0	3
5	CORE	Programming in C	3	0	0	3
6	MD	Numerical and Statistical Methods	3	0	0	3
7	AEC-2	Communication Skills Lab	0	0	3	1.5
8	VAC	Office Automation Tools Lab	0	0	3	1.5
9	CORE	Programming in C Lab	0	0	3	1.5
10	MD	Statistics using R Lab	0	0	3	1.5
Total Credits			17	0	12	23

I Year – II SEMESTER						
S. No	Category	Courses	L	T	P	Credits
1	MD	Discrete Mathematics	3	0	0	3
2	VAC	Environmental Science	2	0	0	2
3	MD	Business Organization	3	0	0	3
4	CORE	Computer Organization	3	0	0	3
5	CORE	Data Structures	3	0	0	3
6	CORE	OOPs through C++	3	0	0	3
7	CORE	Data Structures through C Lab	0	0	3	1.5
8	CORE	OOPs through C++ Lab	0	0	3	1.5
9	VAC	Indian Constitution	2	0	0	2
Total Credits			19	0	6	22



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II Year – I SEMESTER						
S. No	Category	Courses	L	T	P	C
1	CORE	Operating Systems	3	0	0	3
2	CORE	Python Programming	3	0	0	3
3	CORE	Database Management Systems	3	0	0	3
4	CORE	Artificial Intelligence	3	0	0	3
5	CORE	Operating Systems Lab	0	0	3	1.5
6	CORE	Python Programming Lab	0	0	3	1.5
7	CORE	Database Management Systems Lab	0	0	3	1.5
8	SEC	Animation Design	0	0	3	1.5
9	SEC	Design Thinking and Innovation	0	1	2	2
Total Credits			20			

II Year – II SEMESTER						
S. No	Category	Courses	L	T	P	C
1	CORE	Computer Networks	3	0	0	3
2	SEC	JAVA Programming	3	0	0	3
3	CORE	Web Technologies	3	0	0	3
4	CORE	Software Engineering	3	0	0	3
5	CORE	Computer Networks Lab	0	0	3	1.5
6	SEC	Android APP Development	0	0	3	1.5
7	SEC	JAVA Programming Lab	0	0	3	1.5
8	SEC	Web Technologies Lab	0	0	3	1.5
9	SI	Summer Internship and Seminar*	-	-	-	2
Total Credits			20			

* Evaluated during the V Sem



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III Year – I SEMESTER						
S. No	Category	Courses	L	T	P	C
1	CORE	Introduction to Data Mining	3	0	0	3
2	CORE	OOAD using UML	3	0	0	3
3	Minor	1. Management Information System 2. Generative AI	3	0	0	3
4	Minor	1. Social Media Marketing 2. Foundations of Data Science	3	0	0	3
5	Minor	1. E- Commerce 2. Unix Programming	3	0	0	3
6	CORE	Data Mining Lab	0	0	3	1.5
7	CORE	OOAD Using UML Lab	0	0	3	1.5
8	AEC	English for Technical Writing	2	0	0	2
Total Credits			20	0	6	20

III Year – II SEMESTER						
S. No	Category	Courses	L	T	P	C
1	CORE	Introduction to Cyber Security	3	0	0	3
2	Minor	1. Software Project Management 2. Machine Learning	3	0	0	3
3	Minor	Internet of Things Or MOOCS - NPTEL - Recommended 12 week 3 credit course 1. Introduction to Industry 4.0 and Industrial Internet of Things 2. Design, Technology and Innovation	3	0	0	3
4	Minor	Big Data Technologies Or MOOCS - NPTEL - Recommended 8 week 2 credit course 1. Introduction to Graph Algorithms 2. Distributed Systems	2	0	0	2
5	AEC	Research Methodology	2	0	0	2
6	Minor (Stream)	Minor Project and Seminar	0	0	0	2
Total Credits			13	0	6	15



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IV Year – I SEMESTER						
S. No	Category	Courses	L	T	P	C
1	CORE	Design and Analysis of Algorithms	3	1	0	4
2	CORE	Cryptography & Network Security	3	1	0	4
3	Minor	1. Data Analysis with Power BI 2. Blockchain Foundations	3	0	0	3
4	Minor	1. Compiler Design 2. Software Testing	3	0	0	3
5	CORE	Network Programming	3	0	0	3
6	CORE	Cryptography & Network Security Lab	0	0	3	1.5
7	CORE	Network Programming Lab	0	0	3	1.5
Total Credits			18	2	3	20

IV Year – II SEMESTER						
S. No	Category	Courses	L	T	P	C
1	Minor	1. Resource Management Techniques 2. Search Engine Optimization	3	0	0	3
2	Minor	Quantum Science & Technology Or MOOCS - NPTEL - Recommended 12 week 3 credit course 1. Design & Implementation of Human-Computer Interfaces 2. Ethical Hacking	3	0	0	3
3	Minor	DevOps Or MOOCS - NPTEL - Recommended 8 week 2 credit course	2	0	0	2
4	RPD	Research Project / Dissertation	0	0	0	12
Total Credits			8	0	0	20



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I Year – I Semester

L	T	P	C
3	0	0	3

COMMUNICATIVE ENGLISH

Course Objectives:

The main objective of introducing this course, *Communicative English*, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

UNIT I

Lesson: HUMAN VALUES: Gift of Magi (Short Story)

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II

Lesson: NATURE: The Brook by Alfred Tennyson (Poem)

Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Structure of a paragraph - Paragraph writing (specific topics)

Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions.

Vocabulary: Homonyms, Homophones, Homographs.

UNIT III

Lesson: BIOGRAPHY: Elon Musk

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed

Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.



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Writing: Summarizing, Note-making, paraphrasing

Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations

Vocabulary: Compound words, Collocations

UNIT IV

Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Letter Writing: Official Letters, Resumes

Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons

UNIT V

Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic contexts

Reading: Reading comprehension.

Writing: Writing structured essays on specific topics.

Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Vocabulary: Technical Jargons

Textbooks:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

Reference Books:

1. Dubey, Sham Ji& Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.



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Web Resources:

GRAMMAR:

1. www.bbc.co.uk/learningenglish
2. <https://dictionary.cambridge.org/grammar/british-grammar/>
3. www.eslpod.com/index.html
4. <https://www.learngrammar.net/>
5. <https://english4today.com/english-grammar-online-with-quizzes/>
6. <https://www.talkenglish.com/grammar/grammar.aspx>

VOCABULARY

1. <https://www.youtube.com/c/DailyVideoVocabulary/videos>
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA



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I Year – I Semester

L	T	P	C
3	0	0	3

COMPUTER FUNDAMENTALS

Course Objectives:

The main objective of this course is to introduce the fundamentals of computing devices and the Internet,. It focuses on computer literacy that prepares students for life-long learning of computer concepts and skills.

Unit I:

Knowing computer: computer definition, applications of computer, components of a computer system, Central Processing Unit(CPU), Video Display Unit, Keyboard and Mouse, Optical Storage devices, basics of hard drive, concepts of hardware and software, concept of computing, data and information, applications of information electronics and communication technology, connecting keyboard, mouse, monitor and printer to CPU and checking power supply

Computer software & its types: system software, application software, types of operating system, role of operating system, utility programs, packages, communication software, commonly used application software

Unit II:

Operating computer using GUI based operating system: operating systems basics, basics of popular operating systems, the user interface, basics of operating system setup, common utilities

MS Windows Operating System: definition and functions, basic components of Windows, Icons, Desktop, Taskbar, Notification area, files and folders, start menu operations, my computer, network neighborhood, recycle bin, windows explorer, setting wall paper, creating, copying, moving and deleting files, changing the mouse pointer, paint, notepad, setting date and time, screen saver, using mouse: using right mouse button moving icons on the screen, use of common icons, status bar, using menu and menu selections, running an application, viewing of files, folder sand directories, creating and renaming of files and folders, opening and closing of different windows, using help, crating shortcuts, using Windows accessories.

Unit III:

MS-Word: introduction, Windows interface, document views, creating & editing documents, selecting, deleting, replacing text, copying text to another file, formatting text, paragraphs, fonts, paragraph formatting using bullets and numbering, dialog box, checking spellings, line spacing, margins, space before and after paragraph, mail merge, macros, printing documents, print preview

MS Excel: introduction, workbook, worksheet, formatting, formulas, charts

MS Power point: introduction, creating presentation with all options, slide show, animations and designs



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Unit IV:

Introduction to Internet, WWW, Web browsers

Basics of computer networks, LAN, WAN, concept of Internet, web browsing software, search engines, understanding URLs, domain name, IP address

Basics of electronic mail, getting and email account, sending and receiving mails, document collaboration

Unit V:

Useful Google tools such as drive, sheet, doc, meet etc.,

Firewall, computer virus, Anti virus software, Internet security and privacy,

Basics of Electronic Data Interchange, Electronic Payment systems, Types of payment systems, digital cash, electronic cheque, smart card, introduction to digital signatures

Text Books:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education
2. Computer Fundamentals, A. Goel, 2010, Pearson Education.
3. Fundamentals of Computers, P. K.Sinha& P. Sinha, 2007, BPB Publishers.
4. Fundamentals of Information Technology: Alexis Leon & Mathews Leon, Vikas Publishing House, New Delhi
5. IT Tools, R.K. Jain, Khanna Publishing House
6. Introduction to Information Technology, Satish Jain, AmbrishRai&Shashi Singh, Paperback Edition, BPB Publications, 2014.

Web Resources:

1. <https://edu.gcfglobal.org/en/computerbasics/>
2. <https://edu.gcfglobal.org/en/subjects/office/>
3. https://onlinecourses.swayam2.ac.in/nou20_cs03/
4. https://tutorialpoint.com/computer_fundamentals/index.htm
5. <https://nptel.ac.in/courses/106/103/106103068/>



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I Year – I Semester

L	T	P	C
2	0	0	2

FUNDAMENTALS OF COMMERCE

Course Objectives:

The objective of this paper is to help students to acquire conceptual knowledge of the Commerce, Economy and Role of Commerce in Economic Development. To acquire Knowledge on Accounting and Taxation.

Unit I:

Introduction: Definition of Commerce, Role of Commerce in Economic Development, Role Commerce in Societal Development. Imports and Exports, Balance of Payments. World Trade Organization.

Unit II:

Economic Theory: Macro Economics, Meaning, Definition, Measurements of National Income, Concepts of National Income. Micro Economics, Demand and Supply. Elasticity of Demand and Supply. Classification of Markets, Perfect Competition, Characteristics, Equilibrium Price, Marginal Utility.

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Unit III:

Accounting Principles: Meaning and Objectives Accounting, Accounting Cycle, Branches of Accounting, Financial Accounting, Cost Accounting, Management Accounting. Concepts and Conventions of Accounting – GAAP.

Unit IV:

Taxation: Meaning of Tax, Taxation, Types of Tax, Income Tax, Corporate Taxation, GST, Customs & Exercise. Differences between Direct and Indirect Tax, Objectives of Tax, Concerned authorities, Central Board of Direct Taxes (CBDT) and Central Board of Excise and Customs (CBIC).

Unit V:

Computer Essentials: Web Design, Word Press Basics, Developing a Simple Website. Digital Marketing, Social Media Marketing, Content Marketing, Search Engine Optimization(SEO), E-mail Marketing. Data Analytics, Prediction of customer behavior, customized suggestions.

Reference Books:

1. S.P. Jain & K.L Narang, Accountancy - I Kalyani Publishers.
2. R.L. Gupta & V.K. Gupta, Principles and Practice of Accounting, Sultan Chand
3. Business Economics -S.Sankaran, Margham Publications, Chennai.
4. Business Economics - Kalyani Publications.
5. Dr. Vinod K. Singhania: Direct Taxes – Law and Practice, Taxmann Publications.
6. Dr. Mehrotra and Dr. Goyal: Direct Taxes – Law and Practice, SahityaBhavan Publications



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L	T	P	C
3	0	0	3

DIGITAL LOGIC DESIGN

Course Objectives:

The main objectives of the course are to

- Understand different methods used for the simplification of Boolean functions and binary arithmetic.
- Design and implement combinational circuits, synchronous & asynchronous sequential circuits.

UNIT I:

Binary Systems: Digital Systems, Binary Numbers, Number Base Conversions, Octal and Hexadecimal Numbers, Complements, Signed Binary Numbers, Binary Codes, Binary Storage and Registers, Binary Logic.

Boolean Algebra and Logic Gates: Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates.

UNIT II:

Minimization: K-Map Method – Tabulation Method, POS - SOP, Don't Care Conditions, NAND, NOR Implementation.

Combinational Logic: Combinational Circuits, Analysis and Design Procedure, Binary Adder, Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers.

UNIT III:

Synchronous Sequential Logic: Sequential Circuits - Latches, Flip-Flops, An analysis of Clocked Sequential Circuits, State Reduction and Assignment Design Procedure.

UNIT IV:

Registers and Counters: Registers, Shift Registers, Ripple Counters, Synchronous Counters, Ring Counters-Johnson Counter.

UNIT V:

Asynchronous Sequential Circuit : Introduction, Analysis Procedure, Circuits with Latches, Design Procedure.

Text Books:

1. M. Morris Mano, "Digital Design", 3rd edition, Pearson Education, Delhi, 2007.
2. Carl Hamacher, Z. Vranesic, S. Zaky: Computer Organization, 5/e (TMH)



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Reference Books:

1. Donald P Leech, Albert Paul Malvino and GoutamSaha, “Digital Principles and Applications”, Tata McGraw Hill, 2007.

Web Resources:

1. <https://nptel.ac.in/courses/117105080>
2. [Digital Logic Design: Theory \(CS226\) + Lab \(CS254\) \(iitb.ac.in\)](#)
3. [Free Course: Digital Logic and Circuits Simulations from Banaras Hindu University | Class Central](#)



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L	T	P	C
3	0	0	3

PROGRAMMING IN C

Course Objectives:

The main objectives of the course is to

- Introduce students to the fundamentals of computer programming.
- Provide hands-on experience with coding and debugging.
- Foster logical thinking and problem-solving skills using programming.
- Familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- Encourage collaborative learning and teamwork in coding projects.

UNIT I:

Introduction to Programming and Problem Solving: History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting. Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT II :

Control Structures: Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) and Unconditional statements: goto, Break and Continue.

UNIT III:

Arrays and Strings: Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings and string Operations

UNIT IV:

Pointers & User Defined Data types: Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

UNIT V:

Functions & File Handling: Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters, Recursive functions. Scope and Lifetime of Variables, Basics of File Handling



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Text Books:

1. E. Balagurusamy, “Programming in ANSI C”, 4/e, TMH
2. Dr N B Venlateswarlu, “ C Programming”, S Chand Publications
3. Yashwant Kanetkar , “Let Us C: Authentic guide to C programming language”, 19th Edition, BPB publications
4. B. Kernighan & Dennis Ritchie, “The C Programming Language”, 2/e PHI

Reference Books:

1. Paul Deitel, Harvey Deitel, “C: How to Program”, 8/e, Prentice Hall.
2. Schaum’s Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

Web Resources:

1. [Introduction to Programming in C - Course \(nptel.ac.in\)](https://nptel.ac.in/courses/106105171)
2. [Lecture Notes | Practical Programming in C | Electrical Engineering and Computer Science | MIT OpenCourseWare](https://nptel.ac.in/courses/106105171)
3. <https://nptel.ac.in/courses/106105171>
4. <http://cslibrary.stanford.edu/>



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I Year – I Semester

L	T	P	C
3	0	0	3

NUMERICAL AND STATISTICAL METHODS

Course Objectives:

The main objectives of the course are:

- To learn how to perform error analysis for arithmetic operations.
- To demonstrate working of various numerical methods.
- To provide a basic understanding of the derivation and use of methods of interpolation and numerical integration.
- To impart knowledge of various statistical techniques.
- To develop students understanding through laboratory activities to solve problems related to above stated concepts.

UNIT I:

Solution of equations (polynomial and transcendental equations) interval having methods, secant, Regula – Falsi, Newton – Raphson methods, Fixed point Iteration method.

UNIT II:

Solution of system of linear equations: Gauss – Elimination method, Gauss – Jordan, Gauss – Siedel iteration method, LU- Decomposition method, Eigen values and Eigen vectors of a square matrix.

UNIT III:

Interpolation: Forward and backward differences, Newton's forward and backward formula, Lagrange's interpolation and Lagrange's inverse interpolation formula. Numerical differentiation, integration: Numerical differentiation forward and backward formula, Trapezoidal and Simpsons formulas.

UNIT IV:

Basic concepts and definition of statistics : Mean ,Median , Mode , standard deviation , coefficient of variation, skewness and kurtosis ,Karl Pearson Correlation coefficient , Rank Correlation and illustrated examples .

UNIT V:

Probability : Basic concepts and definition of probability , Probability axioms , Conditional probability , Addition and Multiplication theorem of probability (Based on set theory concepts) , Bayes theorem , problems and applications .

Text Books:

1. Sunil S .Patil Numerical and Statistical Methods EBPB.
2. S.S.Shastry Introductory methods of Numerical Analysis PHI (New Delhi).

Reference Books:

1. Gupta S.C &Kapuram VK Fundamentals of Mathematical Statistics.



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I Year – I Semester

L	T	P	C
0	0	3	1.5

COMMUNICATION SKILLS LAB

Course Objectives:

The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews.

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

Suggested Software:

- Walden Infotech
- Young India Films

Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma. *Technical Communication*. Oxford Press. 2018.
2. Taylor Grant: *English Conversation Practice*, Tata McGraw-Hill Education India, 2016
3. Hewing's, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
4. J. Sethi & P.V. Dhamija. *A Course in Phonetics and Spoken English*, (2nd Ed) , Kindle, 2013

Web Resources:

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. <http://www.britishcouncil.in/english/online>
5. <http://www.letstalkpodcast.com/>
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. <https://www.youtube.com/c/ArnelsEverydayEnglish/featured>
8. <https://www.youtube.com/c/engvidAdam/featured>



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9. <https://www.youtube.com/c/EnglishClass101/featured>
10. <https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists>
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. <https://www.youtube.com/user/letstalkaccent/videos>
2. <https://www.youtube.com/c/EngLanguageClub/featured>
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA



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L	T	P	C
0	0	3	1.5

OFFICE AUTOMATION TOOLS LAB

Course Objectives:

- To introduce the environment of GUI in Ms-Word and its features..
- To introduce the fundamental concepts using Ms-Word and its features to make it more useful.
- To provide hands-on use of Word, Excel and PowerPoint.

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition.

Experience the following:

Binary Arithmetic (<https://scratch.mit.edu/projects/613350058>)

Full adder circuit (<https://logic.ly/demo/> and <https://logic.ly/demo/samples>)

This app is to test unsigned binary numbers to decimal number conversion skill of the students. <https://scratch.mit.edu/projects/621571989>

Task 3: Installation of MS windows on the personal computer.

Task 4: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 5: Creation of Gmail account, accessing Google Drive including Google Docs

Task 6: Create a document to write a letter to the DM&HO of the district complaining about Hygienic conditions in your area. (*Similar Letters)

Task 7: Create a document to share your experience of your recent vacation with family.

Task 8: Create a document to send a holiday intimation to all the parents at time about Dasara Vacation. (using mail merge)

Task 9: Create a document to create Time Table of you class using tables.

Task 10: Create a table with following columns and display the result in separate cells for the following

- Emp Name, Basic pay, DA, HRA, Total salary.



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- Sort all the employees in ascending order with the name as the key
- Calculate the total salary of the employee
- Calculate the Grand total salary of the employee

Task 11: Create two pages of curriculum vitae of a graduate with the following specifications

- Table to show qualifications with proper headings
- Appropriate left and right margins
- Format ½pageusingtwo-columnapproachabout yourself
- Name on each page at the top right side
- Page no. in the footer on the right side

Task 12: Create a letter as the main document and create 10 records for the 10 persons. Use mail merge to create letter for selected persons among 10.

Task 13:Create a worksheet with you class marks displaying total, average, top marks in the class and least marks in the class.

Task 14: Create a Worksheet with employee no, name, job, salaries of 10 employees, calculate DA,TA,HRA ,Gross Salary and Net Salary.

- i. Find the sum of HRA's of Total employees.
- ii. Find the average DA
- iii. Display the Maximum salary of the employee.

Task 15: Prepare a chart with height and weights of you class mates in at least 3 types of charts.

Task 16: Demonstrate the use of Filter with the attendance data of your class.

Task 17: Prepare a presentation with your achievements and experiences in College.

Task 18: Create a Presentation of your organization with pictures, clip arts and animations

Task 19: Create a presentation using templates.

Task 20: Create a Custom layout or Slide Master for professional presentation.

Task 21: Create a presentation with slide transitions and animation effects.

Task 22: Create a table in PPT and apply graphical representation



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Text Books:

1. Computer Fundamentals–Pradeep .K. Sinha: BPB Publications.
2. Joy of Computing: ABC of bits, trits, qubits, bytes, trytes, qutrits, quids for kids to Teachers, N B V Venkateswarlu, 2022
3. Fundamentals of Computers –ReemaThareja, Oxford University Press India

Web Resources:

1. https://onlinecourses.swayam2.ac.in/cec21_cs15/preview
2. <https://edu.gcfglobal.org/en/computerbasics/>
3. <https://www.computerhope.com/jargon/m/microsoft-word.htm>
4. <https://www.coursera.org/courses?query=office%20automation>



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PROGRAMMING in C LAB

Course Objectives:

The course aims to give students hands on experience and train them on the concepts of the C- programming language.

UNIT I

Suggested Experiments/Activities

WEEK 1: Lab1: Familiarization with programming environment

- Basic Linux environment and its editors like Vi, Vim & Emacs etc.
- Exposure to Turbo C, gcc
- Writing simple programs using input and Output Statements
- Simple Arithmetic Operations

WEEK 2: Lab2: Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

- Simple statistics Operations- Sum and average etc
- Conversion of Fahrenheit to Celsius and vice versa
- Simple and Compound Interest calculation

WEEK 3: Lab 3: Simple computational problems using arithmetic expressions.

- Finding the square root of a given number
- Finding compound interest
- Area of a triangle using heron's formulae
- Distance travelled by an object

WEEK 4: Lab 4: Simple computational problems using the operator precedence and associativity

- Evaluate the following expressions.
 - $A+B*C+(D*E) + F*G$
 - $A/B*C-B+A*D/3$
 - $A+++B---A$
 - $J=(i++) + (++i)$
- Find the maximum of three numbers using conditional operator

WEEK 5: Lab 5: Problems involving if-then-else structures.

- Find the max and min of four numbers using if-else.
- Generate electricity bill.
- Find the roots of the quadratic equation.
- Simulate a calculator using switch case.
- Find the given year is a leap year or not etc

WEEK 6: Lab 6: Iterative problems e.g., series and sequences

- Find the factorial of given number using any loop.
- Find the given number is a prime or not.
- Checking a number is palindrome or not



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WEEK 7: Lab 7: 1D Array manipulation, linear search

- i) Find the min and max of a 1-D integer array.
- ii) Perform linear search on 1D array.
- iii) The reverse of a 1D integer array

WEEK 8: Lab 8: Matrix problems, String operations

- i) Addition of two matrices
- ii) Multiplication two matrices
- iii) Sort array elements
- iv) Concatenate two strings without built-in functions
- v) Reverse a string using built-in and without built-in string functions

WEEK 9: Lab 9: Pointers and structures, memory dereference.

- i) Write a C program to find the sum of a 1D array using malloc()
- ii) Write a C program to find the total, average of n students using structures
- iii) Enter n students data using calloc() and display failed students list

WEEK 10: Lab 10 :

- i) Demonstrate the differences between structures and unions using a C program.
- ii) Write a C program to copy one structure variable to another structure of the same type.

WEEK 11: Lab 11: Write a C program to swap two numbers (Use call by value and call by reference)

WEEK 12: Lab 12: Recursive functions

- i) Generate Fibonacci series.
- ii) Find the LCM of two numbers.
- iii) Find the factorial of a number.

WEEK 13: Lab 13: File operations

- i) Write and read text into a file.
- ii) Write and read text into a binary file
- iii) Copy the contents of one file to another file.
- iv) Find no. of lines, words and characters in a file

Text Books:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw Hill
3. Dr N B Venlateswarlu, "C Programming", S Chand Publications

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India
2. C Programming, A Problem-Solving Approach, Forouzan,



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Web Resources:

1. [Department of Computer Science and Technology – Course pages 2021–22: Programming in C and C++ – Course materials \(cam.ac.uk\)](#)
2. [Practical Programming in C | Electrical Engineering and Computer Science | MIT OpenCourseWare](#)
3. [Lab 1: Introduction to C | Systems, Networks, and Concurrency \(anu.edu.au\)](#)
4. [<https://ps-iiith.vlabs.ac.in/>](#)
5. [<https://www.learn-c.org/>](#)



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0	0	3	1.5

STATISTICS USING R LAB

Exercise 0:

Installing R and R Studio

Basic functionality of R

Exercise 1:

- Write an R program to print Hello World
- Write a program to demonstrate the basic Arithmetic in R
- Write a program to demonstrate the Variable assignment in R

Exercise 2:

- Write a program to demonstrate the data types in R
- Write a program to demonstrate the creating and naming a vector in R
- Write a program to demonstrate the create a matrix and naming matrix in R

Exercise 3:

- Write a program to demonstrate the Add column and Add a Row in Matrix in R
- Write a program to demonstrate the selection of elements in Matrixes in R
- Write a program to demonstrate the Performing Arithmetic of Matrices

Exercise 4:

- Write a program to demonstrate the Factors in R
- Implement the Factor in R
- Write a program to illustrate Ordered Factors in R

Exercise 5:

- Write an R program to take input from the user.
- Write an R program to Check if a Number is Odd or Even
- Write an R program to check if the given number is a Prime Number

Exercise 6:

- Write an R program to Find the Factorial of a Number
- Write an R program to Find the Factors of a Number
- Write an R program to Find the Fibonacci sequence Using Recursive Function

Exercise 7:

- Write an R program to make a Simple Calculator
- Write an R program to Find L.C.M of two numbers
- Write an R program to create a Vector and to access elements in a Vector



Exercise 8:

- a) Write an R program to create a Matrix and access rows and columns using functions *colnames()* and *rownames()* .
- b) Write an R Program to create a Matrix using *cbind()* and *rbind()* functions.

Exercise 9:

- a) Write an R Program to create a Matrix from a Vector using the ***dim()*** function.
- b) Write an R Program to create a List and modify its components.
- c) Write an R Program to create a Data Frame.

Exercise 10:

- a) Write an R Program to access a Data Frame like a List.
- b) Write an R Program to access a Data Frame like a Matrix.
- c) Write an R Program to create a Factor.

Exercise 11:

- a) Write an R Program to Access and Modify Components of a Factor.
- b) Write an R Program to create an S3 Class and S3 Objects.
- c) Write an R Program to write an own generic function in S3 Class.

Exercise 12:

- a) Write an R Program to create an S4 Class and S4 Objects.
- b) Write an R Program to write an own generic function in S4 Class.
- c) Write an R Program to create a reference class and modify its methods.

Exercise 13:

- a) Write an R program to create a scatter plot for the data frame columns.
- b) Write an R program to create a bar plot for the data frame columns.
- c) Write an R program to create a box plot for the data frame columns.

Exercise 14:

- a) Write an R program to add the legend to the plot.
- b) Write an R program to change the width and height of the plot layout
- c) Write an R program to calculate mean, mode, median and standard deviation
- d) Implement R Script to create a Pie chart, Bar Chart, scatter plot and Histogram.

Exercise 15:

- a) Implement R Script to perform Normal, Binomial distributions.
- b) Implement R Script to perform correlation

References:

- 1. R Cookbook Paperback – 2011 by Teetor Paul O Reilly Publications



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2. Beginning R: The Statistical Programming Language by Dr. Mark Gardener, Wiley Publications
3. R Programming For Dummies by JorisMeysAndrie de Vries, Wiley Publications
4. Hands-On Programming with R by Grolemund, O Reilly Publications
5. Statistical Programming in R by KG Srinivas G.M. Siddesh, ChetanShetty&Sowmya B.J. - 2017 edition
6. R Fundamentals and Programming Techniques, Thomas Lumely.
7. R for Everyone Advanced Analytics and Graphics, Jared P. Lander- Addison Wesley Series
8. The Art of R Programming, Norman Matloff, Cengage Learning

Web Links:

1. URL: <https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf>
2. <http://nptel.ac.in/courses/106104135/48>
3. <http://nptel.ac.in/courses/110106064/>

Software Requirements:

1. The R statistical software program. Available from: <https://www.r-project.org/>
2. RStudio an Integrated Development Environment (IDE) for R. Available from: <https://www.rstudio.com/>



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I Year – II Semester

L	T	P	C
3	0	0	3

DISCRETE MATHEMATICS

Course Objectives:

- To learn the mathematical foundations for Computer Science.
- Topics covered essential for understanding various courses.

Unit-I:

Mathematical Logic: *Propositional Calculus:* Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof, *Predicate Calculus:* Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

Unit-II:

Sets and Functions: Sets, Relations, Functions, Closures of Equivalence Relations, Partial ordering well ordering, Lattice, Sum of products and product of sums principle of Inclusions and Exclusions

Unit III:

Combinatory: Permutations, Combinations, Pigeonhole principle

Recurrence Relation: Linear and Non-linear Recurrence Relations, Solving Recurrence Relation using Generating Functions.

Unit IV:

Graphs: Introduction to graphs, graphs terminologies, Representation of graphs, Isomorphism

Connectivity & Paths: Connectivity, Euler and Hamiltonian Paths, Introduction to tree, tree traversals, spanning tree and tree searches: Breadth first search, Depth first search, cut-set, cut-vertex.

Unit-V:

Modeling Computation: Finite State Machine, Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA), Grammars and Language, Application of Pumping Lemma for Regular Language.

Text Books:

1. Discrete Mathematics and its Applications with Combinatory and Graph Theory, 7th edition by Kenneth H. Rosen.
2. Discrete Mathematical Structures with Applications to Computer Science, J. P Tremblay, R. Manohar, TMH, 1997.



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3. Elements of Discrete Mathematics-A Computer Oriented Approach, *C. L. Liu and D. P. Mohapatra*, 3rd Edition, Tata McGraw Hill.
4. Discrete Mathematics, An open Introduction, Oscar Levin, 3rd edition

Reference Books:

1. Elements of Discrete Mathematics by C. L. Liu and D.P. Mohapatra, TMH, 2012
2. A Modern Approach to Discrete Mathematics and Structure by J. K. Mantri & T. K. Tripathy, Laxmi Publication

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs123/preview
2. <https://discrete.openmathbooks.org/preview/>
3. <https://mathworld.wolfram.com/topics/DiscreteMathematics.html>
4. <https://www.csie.ntu.edu.tw/~sylee/courses/dm/resources.htm>



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I Year – II Semester

L	T	P	C
2	0	0	2

ENVIRONMENTAL SCIENCE

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

UNIT-I

Multidisciplinary Nature Of Environmental Studies: Definition, Scope and Importance, Need for Public Awareness.

Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems, Forest resources, Use and over, exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people, Water resources, Use and over utilization of surface and ground water, Floods, drought, conflicts over water, dams–benefits and problems, Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies: Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies: Energy resources.

UNIT-II

Ecosystems: Concept of an ecosystem. Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids: Introduction, types, characteristic features, structure and function of the following ecosystem:

- a. Forest ecosystem.
- b. Grassl and ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation: Introduction Definition: genetic, species and ecosystem diversity– Bio-geographical classification of India, Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.



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UNIT–III

Environmental Pollution: Definition, Cause, effects and control measures of:

- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides.

UNIT–IV

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Case studies: Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies: Wastel and reclamation. Consumerism and waste products. Environment Protection Act, Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act, Wild life Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

.

UNIT–V

Human Population And The Environment: Population growth, variation among nations. Population explosion, Family Welfare Programmes. Environment and human health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of information Technology in Environment and human health–Case studies. Field Work: Visitto a local area to document environmental assets River/ forest grassland/ hill/ mountain, Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds–river, hills lopes, etc..

Text books:

1. Text book of Environmental Studies for Undergraduate Courses ErachBharucha for University Grants Commission ,Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S. AzeemUnnisa,“ Environmental Studies” Academic Publishing Company
4. K. RaghavanNambiar,“ Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.



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Reference Books:

1. Deeksha Dave and E. Sai Baba Reddy, “Text book of Environmental Science”, Cengage Publications.
2. M. Anji Reddy, “Text book of Environmental Sciences and Technology”, B S Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J.Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice Hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies ”Himalaya Publishing House
6. Gilbert M. Masters and Wendell P.Ela, “Introduction to Environmental Engineering and Science , Prentice Hall of India Private limited.



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L	T	P	C
3	0	0	3

BUSINESS ORGANIZATION

Course Objectives:

The course aims to acquire conceptual knowledge of business, formation various business organizations. To provide the knowledge on deciding plant location, plan layout and business combinations.

Unit I:

Business: Concept, Meaning, Features, Stages of development of business and importance of business. Classification of Business Activities. Meaning, Characteristics, Importance and Objectives of Business Organization..Difference between Industry & Commerce and Business & Profession, Modern Business and their Characteristics.

Unit II:

Promotion of Business: Considerations in Establishing New Business. Qualities of a Successful Businessman. Forms of Business Organization - Sole Proprietorship, Partnership, Joint Stock Companies & Co-operatives and their Characteristics, relative merits and demerits, Difference between Private and Public Company, Concept of One Person Company.

Unit III:

Plant Location and Layout: Meaning, Importance, Factors affecting Plant Location. Plant Layout - Meaning, Objectives, Importance, Types of Layout. Factors affecting Layout. Size of Business Unit - Criteria for Measuring the Size and Factors affecting the Size. Optimum Size and factors determining the Optimum Size.

Unit IV:

Business Combination: Meaning, Characteristics, Objectives, Causes, Forms and Kinds of Business Combination. Rationalization: Meaning, Characteristics, Objectives, Principles, Merits and demerits, Difference between Rationalization and Nationalization.

Unit V:

Computer Essentials: Milestones of Computer Evolution – Computer, Block diagram, generations of computer . Internet Basics - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications. Ethical and Social Implications - Network and security concepts- Information Assurance Fundamentals, Cryptography - Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques, privacy and data protection



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Reference Books:

1. Gupta, C.B., “Business Organisation”, MayurPublication, (2014).
2. Singh, B.P., Chhabra, T.N., “An Introduction to Business Organisation & Management”, KitabMahal, (2014).
3. Sherlekar, S.A. & Sherlekar, V.S., “Modern Business Organization & Management Systems Approach Mumbai”, Himalaya Publishing House, (2000).
4. Bhusan Y. K., “Business Organization”, Sultan Chand & Sons.
5. Prakash, Jagdish, “Business Organization and Management”, KitabMahal Publishers (Hindi and English)
6. Fundamentals of Computers by V. Raja Raman
7. Cyber Security Essentials by James Graham, Richard Howard, Ryan Olson



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L	T	P	C
3	0	0	3

COMPUTER ORGANIZATION

Course Objectives:

The purpose of the course is to introduce principles of computer organization and the basic architectural concepts. It provides an in depth understanding of basic organization, design, programming of a simple digital computer, computer arithmetic, instruction set design, micro programmed control unit, pipelining and vector processing, memory organization and I/O systems

Unit-I:

Basic Structure Of Computers: Computer Types, Functional unit, Basic Operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers. Data Representation. Fixed Point Representation. Floating – Point Representation.

Unit-II:

Register Transfer Language And Micro-operations: Register Transfer language. Register Transfer Bus and memory transfers, Arithmetic Micro-operations, Logic micro operations, shift micro operations, Arithmetic logic shift unit. Instruction codes. Computer Registers, Computer instructions, Instruction cycle.

UNIT III:

Micro Programmed Control: Control memory, Address sequencing, micro program example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.

UNIT IV:

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory, Cache memories performance considerations, Virtual memories Introduction to Shift registers and RAID

UNIT V:

Input –Output Organization Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, DMA, Input Output Processor, Serial Communication.

Text Books:

1. Digital Logic and Computer Design, Moriss Mano, 11th Edition, Pearson Education.
2. Computer Organiza tion, 5thed.,Hamacher, Vranesicand Zaky,TMH,2002
3. Computer System Architecture, 3/e, Moris Mano, Pearson/PHI.



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Reference Books:

1. Computer System Organization & Architecture, John D. Carpinelli, Pearson, 2008
2. Computer System Organization, Naresh Jotwani, TMH, 2009
3. Computer Organization & Architecture: Designing for Performance, 7th ed., William Stallings, PHI, 2006
4. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson.

Web Resources:

1. <https://nptelvideos.com/course.php?id=396>
2. https://onlinecourses.nptel.ac.in/noc20_cs64/preview
3. <https://www.learncomputerscienceonline.com/computer-organization-and-architecture/>
4. <http://williamstallings.com/COA/COA8e-student/index.html>



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I Year – II Semester

L	T	P	C
3	0	0	3

DATA STRUCTURES

Course Objectives:

- Solve problems using data structures such as linear lists, stacks, queues, hash tables
- Be familiar with advanced data structures such as binary search trees

UNIT- I:

Searching: Linear and Binary Search Methods.

Sorting: Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort.

Introduction to Data Structures: Abstract Data Types (ADTs), The List ADT: Simple Array Implementation of Lists, Simple Linked Lists, Doubly Linked Lists, Circularly Linked Lists.

UNIT-II:

The Stack ADT: The Stack Model, Implementation of Stacks, Applications of Stack. **The**

Queue ADT: Queue Model, Array Implementation of Queues, Application of Queues, Stacks and Queue. implementation of stacks and queues using linked list.

UNIT- III:

Hashing: Hash Function, Separate Chaining, Collision Resolution-Separate Chaining, Open Addressing: Linear Probing, quadratic probing, Double Hashing, rehashing, Extendible Hashing.

UNIT- IV:

Heap: Structure Property, Heap-Order Property, Basic Heap Operations. Applications: The Selection problem, Event Simulation.

Tries, Standard Tries, Compressed Tries, Suffix Tries. (Examples only),

UNIT –V:

Trees: Binary Trees- traversals, Implementation, Expression Trees. Binary Search Trees- find, findMin and findMax, insert, delete operations.

Graphs-Basic Concepts , Storage Structures and Traversals, minimum cost spanning trees

Text Books:

1. Data Structures and Algorithm Analysis, 4th Edition, Mark Allen Weiss, Pearson.
2. Data Structures: A Pseudo Code Approach with C, 2nd Edition, Richard F.Gilberg, &Behrouz A. Forouzon, Cengage.
3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples, N.B.Venkateswarulu, E.V.Prasad, S Chand &Co ,2009.



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References Books:

1. Data Structures, Algorithms and Applications in java, 2/e, SartajSahni, University Press.
2. Data Structures using C, 2/e, ReemaThareja

Web Resources:

1. <https://archive.nptel.ac.in/courses/106/102/106102064/>
2. https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/video_galleries/lecture-videos/
3. <https://www.cs.usfca.edu/~galles/visualization/Algorithms.html>
4. <https://visualgo.net/en>
5. <https://elearn.daffodilvarsity.edu.bd/course/view.php?id=11771>



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I Year – II Semester

L	T	P	C
3	0	0	3

OOPS THROUGH C++

Course Objectives :

This course is designed to provide a comprehensive study of the C programming language.

- It stresses the strengths of C, which provide students with the means of writing efficient, maintainable and portable code.
- The nature of C language is emphasized in the wide variety of examples and applications.
- To know about some popular programming languages and how to choose Programming language for solving a problem.

UNIT I:

Introduction to C++ : Difference between C and C++, Evolution of C++, The Object Oriented Technology, Disadvantage of Conventional Programming, Key Concepts of Object Oriented Programming, Advantage of OOP, Object Oriented Language.

UNIT II:

Classes and Objects & Constructors and Destructor: Classes in C++, Declaring Objects, Access Specifiers and their Scope, Defining Member Function, Overloading Member Function, Nested class, Constructors and Destructors, Introduction, Characteristics of Constructor and Destructor, Application with Constructor, Constructor with Arguments, parameterized Constructor, Destructors, Anonymous Objects.

UNIT III:

Operator Overloading and Type Conversion & Inheritance: The Keyword Operator, Overloading Unary Operator, Operator Return Type, Overloading Assignment Operator (=), Rules for Overloading Operators, Inheritance, Reusability, Types of Inheritance, Diamond Problem, Virtual Base Classes, Object as a Class Member, Abstract Classes, Advantages of Inheritance, Disadvantages of Inheritance

UNIT IV:

Pointers & Binding Polymorphisms and Virtual Functions: Pointer, Features of Pointers, Pointer Declaration, Pointer to Class, Pointer Object, The this Pointer, Pointer to Derived Classes and Base Class, Binding Polymorphisms and Virtual Functions, Introduction, Binding in C++, Virtual Functions, Rules for Virtual Function, Virtual Destructor.

UNIT V:

Templates, Exception Handling: Generic Programming with Templates, Need for Templates, Definition of class Templates, Normal Function Templates, Over Loading of Template Function, Bubble Sort Using Function Templates, Difference Between Templates and Macros, Linked Lists with Templates, Exception Handling, Principles of Exception



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Handling, The Keywords try throw and catch, Multiple Catch Statement, Specifying Exceptions.

Text Books:

1. E. Balaguruswamy, Object Oriented Programming with C++, 6/e, McGraw Hill, 2013.
2. A First Book of C++, Gary Bronson, Cengage Learning.
3. The Complete Reference C++, Herbert Schildt, TMH.
4. Programming in C++, Ashok N Kamthane, Pearson 2nd Edition

Reference Books:

1. Object Oriented Programming with C++ by ReemaThareja, OXFORD University Press
2. Object Oriented Programming C++, Joyce Farrell, Cengage.
3. C++ Programming: from problem analysis to program design, DS Malik, Cengage Learning

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs103/preview
2. <https://ocw.mit.edu/courses/6-088-introduction-to-c-memory-management-and-c-object-oriented-programming-january-iap-2010/pages/lecture-notes/>
3. <https://see.stanford.edu/Course/CS106B>
4. <https://www.udemy.com/course/object-oriented-c-plus-plus-programming/>
5. <https://wiingy.com/learn/cpp/cpp-concepts/>



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I Year – II Semester

L	T	P	C
0	0	3	1.5

DATA STRUCTURES THROUGH C LAB

Course Objectives:

From the course the student will

- Solve problems using data structures such as linear lists, stacks, queues, hash tables
- Be familiar with advanced data structures such as balanced search trees, AVL Trees, and B Trees.

List of experiments:

Experiment 1:

1. Write a C program to perform various operations on single linked list

Experiment 2:

2. Write a C program for the following
 - a) Reverse a linked list
 - b) Sort the data in a linked list

Experiment 3:

3. Write a C program for the following
 - a) Remove duplicates
 - b) Merge two linked lists

Experiment 4:

4. Write a C program to perform various operations on doubly linked list.

Experiment 5:

5. Write a C program to perform various operations on circular linked list.

Experiment 6:

6. Write a C program for performing various operations on stack using linked list.

Experiment 7:

7. Write a C program for performing various operations on queue using linked list.

Experiment 8:

8. Write a C program for the following using stack
 - a) Infix to postfix conversion.
 - b) Expression evaluation.
 - c) Obtain the binary number for a given decimal number.

Experiment 9:

9. Write a C program to implement various operations on Binary Search Tree Using Recursive and Non-Recursive methods.



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Experiment 10:

10. Write a C program to implement Selection Sort & Insertion Sort for given elements.

Experiment 11:

11. Write a C program to implement Merge & Heap Sort for given elements.

Experiment 12:

12. Write a C program to implement Quick Sort for given elements.

Experiment 13:

13. Write a C program to implement various operations on AVL trees.

Experiment 14:

14. Write a C program to perform the following operations:

- a) Insertion into a B-tree b) Searching in a B-tree

Experiment 15:

15. Write a C program to implementation of recursive and non-recursive functions to Binary tree Traversals

Web Resources:

1. <https://ds1-iiith.vlabs.ac.in/>
2. https://profile.iiita.ac.in/bibhas.ghoshal/teaching_ds_lab.html
3. <https://moodle.sit.ac.in/blog/data-structures-laboratory/>
4. <https://dsalab.netlify.app/>
5. <https://www.vtuloop.com/data-structure-lab-programs-all/>



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I Year – II Semester

L	T	P	C
0	0	3	1.5

OOPS THROUGH C++ LAB

Course Objectives:

- To strengthen their problem solving ability by applying the characteristics of an object-oriented approach.
- To introduce object oriented concepts in C++ and Java

Exercise 1: (Basics)

Write a Simple Program on printing “Hello World” and “Hello Name” where name is the input from the user

- a) Convert any two programs that are written in C into C++
- b) Write a description of using g++ (150 Words)

Exercise 2: (Expressions Control Flow)

- a) Write a Program that computes the simple interest and compound interest payable on principal amount (in Rs.) of loan borrowed by the customer from a bank for a given period of time (in years) at specific rate of interest. Further determine whether the bank will benefit by charging simple interest or compound interest.
- b) Write a Program to calculate the fare for the passenger starveling in a bus. When a Passenger enters the bus, the conductor asks “What distance will you travel?” On knowing distance from passenger (as an approximate integer), the conductor mentions the fare to the passenger according to following criteria.

Exercise 3: (Variables, Scope, Allocation)

- a) Write a program to implement call by value and call by reference using reference variable.
- b) Write a program to illustrate scope resolution, new and delete Operators. (Dynamic Memory Allocation)
- c) Write a program to illustrate Storage classes
- d) Write a program to illustrate Enumerations

Exercise 4: (Functions)

Write a program illustrating Inline Functions

- a) Write a program illustrates function overloading. Write 2 overloading functions for power.
- b) Write a program illustrates the use of default arguments for simple interest function.

Exercise 5: (Functions –Exercise Continued)

- a) Write a program to illustrate function overloading. Write 2 overloading functions for adding two numbers
- b) Write a program illustrate function template for power of a number.
- c) Write a program to illustrate function template for swapping of two numbers



Exercise 6: (Classes Objects)

Create a Distance class with:

- feet and inches as data members
 - member function to input distance
 - member function to output distance
 - member function to add two distance objects
- a) Write a main function to create objects of DISTANCE class. Input two distances and output the sum.
 - b) Write a C++ Program to illustrate the use of Constructors and Destructors (use the above program.)
 - c) Write a program for illustrating function overloading in adding the distance between objects (use the above problem)
 - d) Write a C++ program demonstrating a Bank Account with necessary methods and variables

Exercise 7: (Access)

Write a program for illustrating Access Specifiers public, private, protected

- a) Write a program implementing Friend Function
- b) Write a program to illustrate this pointer
- c) Write a Program to illustrate pointer to a class

Exercise 8: (Operator Overloading)

- a) Write a program to Overload Unary, and Binary Operators as Member Function, and Non Member Function.
 - i. Unary operator as member function
 - ii. Binary operator as nonmember function
- b) Write a C ++ program to implement the overloading assignment = operator

Exercise 9: (Inheritance)

- a) Write C++ Programs and incorporating various forms of Inheritance
 - i) Single Inheritance ii) Hierarchical Inheritance iii) Multiple Inheritances

Exercise 10: (Inheritance –Continued)

- a) Write C++ Programs and incorporating various forms of Inheritance
 - i) Multi-level inheritance ii) Hybrid inheritance
- b) Write a program to show Virtual Base Class

Exercise 11: (Inheritance –Continued)

- a) Write a Program in C++ to illustrate the order of execution of constructors and destructors in inheritance
- b) Write a Program to *show how constructors are invoked in derived class*



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Exercise 12: (Polymorphism)

- Write a program to illustrate runtime polymorphism
- Write a program to illustrate this pointer
- Write a program illustrates pure virtual function and calculate the area of different shapes by using abstract class.

Exercise 13: (Templates)

- Write a C++ Program to illustrate template class
- Write a Program to illustrate class templates with multiple parameters
- Write a Program to illustrate member function templates

Exercise 14: (Exception Handling)

- Write a Program for Exception Handling Divide by zero
- Write a Program to rethrow an Exception

Exercise 15: (STL)

- Write a Program to implement List and List Operations
- Write a Program to implement Vector and Vector Operations

Web Resources:

- <https://eecs.wsu.edu/~nroy/courses/cpts122/labs/>
- <https://www.coursera.org/learn/c-plus-plus-a>
- <https://www.educative.io/courses/learn-object-oriented-programming-in-cpp>
- <https://www.udemy.com/course/fundamentals-of-object-oriented-programing-cplusplus/>



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I Year – II Semester

L	T	P	C
2	0	0	2

INDIAN CONSTITUTION

Course Objectives:

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.

UNIT – I:

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working), Philosophy of the Indian Constitution: Preamble, Salient, Features.

UNIT – II:

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT – III:

Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

UNIT – IV:

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive: President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT – V:

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation. Panchayati raj: Introduction, PRI: ZilaPanchayat. Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Text Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication
2. Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, Dr. S. N. Busi, 2015



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Reference Books:

1. Indian Constitution Law, 7th Edition. M. P. Jain, Lexis Nexis, 2014.
2. Introduction to the Constitution of India, Lexis Nexis, D.D. Basu, 2015.



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R24 BCA COURSE STRUCTURE AND SYLLABUS

(Applicable for batches admitted from 2024-2025)

II Year – I Sem	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to make student:

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

UNIT-I:

Introduction to Operating System Concepts: Types of operating systems, operating systems concepts, Evaluation of operating systems, operating systems services, structure of OS, Introduction to System call, System call types.

UNIT-II:

Process Management: Process concept, The process, Process State Diagram, Process control block, Process Scheduling: Scheduling Queues, Schedulers, Operations on Processes, Interprocess Communication, Threading Issues, Scheduling-Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

UNIT-III:

Memory Management: Swapping, Contiguous Memory Allocation, Paging, structure of the Page Table, **Virtual Memory Management:** Virtual Memory, Demand Paging, Page-Replacement Algorithms.

UNIT-IV:

Concurrency: Process Synchronization, The Critical- Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization examples **Principles of deadlock:** System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery form Deadlock

UNIT-V:

File System Interface: Concept of a file, Access Methods, Directory structure, File system mounting, file sharing, protection. **File System Implementation:** File system structure, allocation methods, Disk scheduling.

Text Book:

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne 9th Edition, John Wiley and Sons Inc., 2012.
2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2011.

Reference Books:

1. Operating Systems: A Concept Based Approach, D.M Dhamdhare, 3rd Edition, McGraw- Hill, 2013



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Online Learning Resources:

1. <https://nptel.ac.in/courses/106/106/106106144/>
2. <http://peterindia.net/OperatingSystems.html>



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II Year – I Sem	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to make student

- understand and use scripting Language
- to expose various problems solving approaches of computer science Syllabus

UNIT – I:

Introduction: History of Python, Python Language, Features of Python, Applications of Python, Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

UNIT – II:

Types, Operators and Expressions: Types: Integers, Strings, Booleans; Operators Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations, Control Flow- if, if-elif-else, for, while, break, continue.

UNIT – III:

Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.

UNIT – IV:

Functions: Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

UNIT – V:

Modules: Creating modules, import statement, from. import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions

Text Books:

1. Core Python Programming, W.Chun, Pearson.
2. Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.

Reference Books:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.
2. Think Python, Allen Downey, Green Tea Press
3. Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.

Web-Resources:

https://onlinecourses.nptel.ac.in/noc20_cs83/preview

https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012664745277808640481_shared/overview



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R24 BCA COURSE STRUCTURE AND SYLLABUS

(Applicable for batches admitted from 2024-2025)

II Year – I Sem	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to make student:

- Understand core database concepts including applications, architecture, data models, and the evolution of database systems.
- Design databases using ER modeling, capturing entities, relationships, and constraints, including advanced ER features.
- Apply the relational model, enforce integrity constraints, and convert ER models into relational schemas.
- Use SQL effectively to query, update, and manage databases, including the use of constraints, triggers, and stored procedures.
- Implement normalization techniques to refine schemas, ensure data integrity, and apply various normal forms.

UNIT – I:

Overview of Database System: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Informational Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems. [Text Book -2]

UNIT –II:

Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design with the ER Model, Extended ER features [Text Book -1]

UNIT –III:

Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity Constraints, Querying Relational Data, Logical Database Design: ER to Relational, Introduction to Views, Destroying/Altering Tables and Views [Text Book -1]

UNIT –IV:

SQL: Queries, Constraints, Triggers: The Form of a Basic SQL Query, UNION, INTERSECT and EXCEPT, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers, Exceptions, Procedures, Functions [Text Book -1]

UNIT –V:

Normal Forms: Introduction to Schema Refinement, Functional Dependencies, Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization. [Text Book -1]

Text Books:

1. Data base Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, Mc Graw-Hill
2. Data base System Concepts, 6/e, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Mc Graw-Hill



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Reference Books:

1. Database Systems, 6/e Ramez Elmasri, Shamkant B. Navathe, Pearson
2. Introduction to Database Systems, 8/e, C J Date, Pearson
3. Database Systems, 9/e, Carlos Coronel, Steven Morris, Peter Rob, Cengage

Web-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105175/>
- 2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview



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R24 BCA COURSE STRUCTURE AND SYLLABUS

(Applicable for batches admitted from 2024-2025)

II Year I Sem	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Pre-requisite:

1. Knowledge in Computer Programming.
2. A course on “Mathematical Foundations of Computer Science”.
3. Background in linear algebra, data structures, algorithms and probability.

Course Objectives:

1. The student should be made to study the concepts of Artificial Intelligence, learn the methods of solving problems using Artificial Intelligence.
2. The student should be made to introduce the concepts of applications of AI, namely game playing, theorem proving, and machine learning.
3. To learn different knowledge representation techniques

UNIT – I:

Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT – II:

Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

UNIT – III:

Knowledge Representation: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Bayes’ probabilistic interferences and dempstershafer theory.

UNIT – IV:

Mathematical Logic: First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining,

UNIT – V:

Backward chaining, Resolution, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.



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Textbooks:

1. S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, Second Edition, Pearson Education.
2. Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill

Reference Books:

1. David Poole, Alan Mackworth, Randy Goebel, “Computational Intelligence: a logical approach”, Oxford University Press.
2. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem solving”, Fourth Edition, Pearson Education.
3. J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier Publishers.
4. Artificial Intelligence, Saroj Kaushik, CENGAGE Learning.

Online Learning Resources:

1. <https://ai.google/>
2. https://swayam.gov.in/nd1_noc19_me71/preview



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II Year I Sem	OPERATING SYSTEMS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To implement the scheduling algorithms, page replacement algorithms, file allocation methods, understand and implement IPC mechanism using named and unnamed pipes.

List of Experiments:

1. Write C programs to simulate the following CPU scheduling algorithms:
a) Round Robin b) SJF
2. Write C programs to simulate the following CPU scheduling algorithms:
a) FCFS b) Priority
3. Write C programs to simulate the following File organization techniques:
a) Single level directory b) Two level c) Hierarchical
4. Write C programs to simulate the following File allocation methods:
a) Contiguous b) Linked c) Indexed
5. Write a C program to copy the contents of one file to another using system calls.
6. Write a C program to simulate Bankers Algorithm for Dead Lock Avoidance
7. Write a C program to simulate Bankers Algorithm for Dead Lock Prevention
8. Write C programs to simulate the following page replacement algorithms:
a) FIFO b) LRU c) LFU



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II Year I Sem	PYTHON PROGRAMMING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To be able to introduce core programming basics and various Operators of Python programming language.
- To demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- To understand about Functions, Modules and Regular Expressions in Python Programming

Note : Students are encouraged to practice using Jupyter Notebook and Google Colab.

List of Experiments:

Exercise- 1:

- Write a program to demonstrate different number data types in Python.
- Write a program to perform different Arithmetic Operations on numbers in Python.
- Write a program to create, concatenate and print a string and accessing sub-string from a given string.

Exercise- 2:

- Write a python script to print the current date in the following format “WED 09 02:26:23 IST 2020”
- Write a Python program to convert temperatures to and from Celsius, Fahrenheit [Formula: $c/5 = f-32/9$]
- Write a Python script that prints prime numbers less than 20.

Exercise- 3:

- Write a python program to find factorial of a number using Recursion.
- Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
- Write a Python class to convert an integer to a roman numeral.

Exercise- 4:

- Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.
- Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.

Exercise- 5:

- Write a Python class to implement $\text{pow}(x, n)$
- Write a Python class to reverse a string word by word.
- Write a Python program to print the following triangle
1 2 3 4
2 3 4
3 4
4



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Exercise- 6:

- a. Write a program to count the occurrences of each character in the string and store them in a dictionary data structure
- b. Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.

Exercise- 7 :

- a. Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?
- a. Write a function nearly equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b.

Exercise- 8:

- a. Find mean, median, mode for the given set of numbers in a list
- b. Write a function *dups* to find all duplicates in the list.
- c. Write a function *unique* to find all the unique elements of a list.

Exercise- 9:

- a. Write a program that defines a matrix and prints
- b. Write a program to perform addition of two square matrices
- c. Write a program to perform multiplication of two square matrices



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II Year I Sem	DATABASE MANAGEMENT SYSTEMS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers

Experiments covering the topics:

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures
- Procedures, Functions, Cursors, Triggers,

Sample Experiments:

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables), examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, Constraints.
Example: Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
5.
 - i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
 - ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.
8. Program development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.



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11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers

Text Books/Suggested Reading:

1. Oracle: The Complete Reference by Oracle Press
2. Nilesch Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

Sample Lab Exercise1: ER Diagram and Relational Schema Design

Objective:

To model a real-world application using ER diagrams and convert it into a relational schema.

Problem Statement:

Design an ER diagram for a Student-Course Enrollment System with the following requirements:

- A student has an ID, name, and department.
- A course has a course ID, name, and credits.
- An instructor teaches multiple courses.
- Students enroll in multiple courses.
- Keep track of which instructor teaches which course.

Instructions:

Draw an ER diagram capturing entities, attributes, and relationships.

Convert the ER diagram into relational schemas with primary and foreign keys.

Implement the schema in SQL.



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II Year I Sem	ANIMATION DESIGN	L	T	P	C
		0	0	3	1.5

Course Objectives:

Animation design courses aim to equip students with the skills to create moving images, tell stories through visuals, and work with various animation techniques and software.

List of Experiments:

Experiment 1:

1. Design a logo, brochure, cover letter, visiting cards.
2. Prepare a cutout of some images using Photoshop.
3. Place nice background for those images.

Experiment 2:

1. Prepare nice background using gradient tool.
2. Creating Web Banners in Adobe Flash
3. Creating a Logo Animation in Adobe Flash

Experiment 3:

1. Draw Cartoon Animation using reference.
2. Create Lip Sink to Characters
3. Using filters & Special effects

Experiment 4:

1. Create a scene by using Mask layers animation
2. Create any Model of Cars or Bike,
3. Create any model of the male or female character.

Experiment 5:

1. Create a natural outdoor or indoor scene.
2. Render a frame and video of indoor and outdoor scenes.
3. Advance lighting using mental ray render.

Experiment 6:

1. Animate day and night scene of a street with the help of lighting.
2. Title Graphics
3. Video – Audio synchronization
4. 30 Second Commercial AD

Experiment 7:

1. Creating an effect of snow or rain or smoke or water.
2. Creating an effect of bomb/explosion.

Experiment 8:

1. Create a natural outdoor or indoor scene.
2. Set light for Day, Night and Morning
3. Render a frame and video of indoor and outdoor scenes.



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II Year I Sem	DESIGN THINKING AND INNOVATION	L	T	P	C
		0	1	2	2

Course Objectives:

- Build mindsets & foundations essential for designers
- Learn about the Human-Centered Design methodology and understand their real-world applications
- Use Design Thinking for problem solving methodology for investigating ill-defined problems.
- Undergo several design challenges and work towards the final design challenge

Apply Design Thinking on the following Streams to

- Project Stream 1: Electronics, Robotics, IOT and Sensors
- Project Stream 2: Computer Science and IT Applications
- Project Stream 3: Mechanical and Electrical tools
- Project Stream 4: Eco-friendly solutions for waste management, infrastructure, safety, alternative energy sources, Agriculture, Environmental science and other fields of engineering.

HOW TO PURSUE THE PROJECT WORK?

- The first part will be learning-based-masking students to embrace the methodology by exploring all the phases of design thinking through the wallet/ bag challenge and podcasts.
- The second part will be more discussion-based and will focus on building some necessary skills as designers and learning about complementary material for human-centered design.
- The class will then divide into teams and they will be working with one another for about 2 – 3 weeks. These teams and design challenges will be the basis for the final project and final presentation to be presented.
- The teams start with **Design Challenge** and go through all the phases more in depth from coming up with the right question to empathizing to ideating to prototyping and to testing.
- Outside of class, students will also be gathering the requirements, identifying the challenges, usability, importance etc
- At the end, Students are required to submit the final reports, and will be evaluated by the faculty.

TASKS TO BE DONE:

Task 1: Everyone is a Designer

- Understand class objectives & harness the designer mindset

Task 2: The Wallet/Bag Challenge and Podcast

- Gain a quick introduction to the design thinking methodology
- Go through all stages of the methodology through a simple design challenge
- Podcast: Observe, Listen and Engage with the surrounding environment and identify a design challenge.

Task 3: Teams & Problems (Brain Storming)

- Start Design Challenge and learn about teams & problems through this



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- Foster team collaboration, find inspiration from the environment and learn how to identify problems

Task 4: Empathizing (Brain Storming)

- Continue Design Challenge and learn empathy
- Learn techniques on how to empathize with users
- Go to the field and interview people in their environments
- Submit Activity Card

Task 5: Ideating (Business Planning)

- Continue Design Challenge and learn how to brainstorm effectively
- Encourage exploration and foster spaces for brainstorming
- Submit Activity Card

Task 6: Prototyping (Business Model generation)

- Continue Design Challenge and learn how to create effective prototypes
- Build tangible models and use them as communication tools
- Start giving constructive feedback to classmates and teammates
- Submit Activity Card

Task 7: Testing

- Finish Design Challenge and iterate prototypes and ideas through user feedback
- Evolve ideas and prototypes through user feedback and constructive criticism
- Get peer feedback on individual and group performance
- Submit Activity Card

Task 8: Pitching

- Prepare poster to communicate your idea, how it works, why it counts, and who it benefits.
- Final Report Submission and Presentation

Task 9: Case Study

- Make students groups. Each group will generate a business model for unsolved problems in their organization and present.

Note: The colleges may arrange for Guest Speakers from Various Design Fields: Graphic Design, Industrial Design, Architecture, Product Design, Organizational Design, etc to enrich the students with Design Thinking Concept.

References:

1. Tom Kelly, *The Art of Innovation: Lessons in Creativity From IDEO, America's Leading Design Firm* (Profile Books, 2002)
2. Tim Brown, *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation* (HarperBusiness, 2009)
3. Jeanne Liedtka, Randy Salzman, and Daisy Azer, *Design Thinking for the Greater Good: Innovation in the Social Sector* (Columbia Business School Publishing, 2017)

Other Useful Design Thinking Frameworks and Methodologies:



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- Human-Centered Design Toolkit (IDEO); <https://www.ideo.com/post/design-kit>
- Design Thinking Boot Camp Bootleg (Stanford D-School); <https://dschool.stanford.edu/resources/the-bootcamp-bootleg>
- Collective Action Toolkit (frogdesign); https://www.frogdesign.com/wpcontent/uploads/2016/03/CAT_2.0_English.pdf
- Design Thinking for Educators (IDEO); <https://designthinkingforeducators.com/>



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II Year II Sem	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to provide an understanding of computer networking theory, including principles embodied in the protocols designed for the application layer, transport layer, network layer, and data link layer of a networking stack

UNIT – I:

Introduction: Data Communications, Networks, Network Types, Internet History, Network Models: Protocol Layering, The OSI Model, TCP/IP Protocol Suite, Introduction to Physical Layer: Transmission Impairments, Data Rate Limits, Performance.

UNIT – II:

Introduction to Data-Link- Layer: Link-Layer Addressing, Error Detection and Correction: Block Coding, Cyclic Codes, Checksum Data Link Control: Data-Link Layer Protocols, HDLC, Point-To-Point (PPP), Media Access Control (MAC): ALOHA, CSMA, CSMA/CD, CSMA/CA, Reservation, Polling, Token Passing, FDMA, TDMA, CDMA

UNIT – III:

Introduction to Network Layer: Network-Layer Services, Packet Switching, Network-Layer Performance, IPV4 Addresses, Network Layer Protocols: Internet Protocol (IP), ICMPv4, Mobile IP, Unicast Routing: Routing Algorithms, Unicast Routing Protocols, Next Generation IP: IPv6 Addressing

UNIT – IV:

Introduction to Transport Layer: Introduction, Transport-Layer Protocols, Transport-Layer Protocols: User Datagram Protocol, Transmission Control Protocol: TCP Services, TCP Features, Segment, A TCP Connection, TCP Congestion Control, Flow Control, Error Control

UNIT – V:

Application Layer: WWW, E-MAIL, Domain Name System (DNS), Quality of Service: Flow Control To Improves QoS, Integrated Services

Text Books:

1. Behrouz A. Forouzan, “Data Communications and Networking”, 5th Edition, McGraw Hill Education, 2013.

Reference Books:

1. Andrew S. Tanenbaum, David J. Wetherall, “Computer Networks”, 5th Edition, Prentice Hall, 2011.
2. Larry L. Peterson and Bruce S. Davie, “Computer Networks A System Approach”, 5th Edition, MKP, 2012.
3. James F. Kurose, Keith W. Ross, “Computer Networking, A Top-Down Approach”, 5th Edition, Pearson, 2012.



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Web Resources:

1. <https://www.geeksforgeeks.org/computer-network-tutorials/>
2. <https://codescracker.com/networking/>



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II Year II Sem	JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives:

The learning objectives of this course are to:

- identify Java language components and how they work together in applications
- learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- understand how to design applications with threads in Java
- understand how to use Java APIs for program development

UNIT I:

Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators : Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, **Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II:

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III: Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and



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Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV:

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

UNIT V:

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface

Text Books:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

References Books:

1. The complete Reference Java, 11thedition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Resources:

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview



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II Year II Sem	WEB TECHNOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives:

- To Learn PHP language for server side scripting
- To introduce XML and processing of XML Data with Java
- To introduce Server side programming with Java Servlets and JSP
- To introduce Client side scripting with JavaScript.

Unit I:

Web Basics- Introduction, Concept of Internet- History of Internet, Protocols of Internet, World Wide Web, URL, Web Server, Web Browser. **HTML- Introduction,** History of HTML, Structure of HTML Document: Text Basics, Structure of HTML Document: Images and Multimedia, Links and webs, Document Layout, Creating Forms, Frames and Tables, Cascading style sheets.

Unit II:

XML Introduction- Introduction of XMLXML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemes, Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers in java.

Unit III:

Introduction to Servlets: Common Gateway Interface (CGI), Life cycle of a Servlet, deploying a Servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.

Unit IV:

Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session for session tracking, connecting to database in JSP.

Client-side Scripting: Introduction to JavaScript, JavaScript language – declaring variables, scope of variables, functions. event handlers (onClick, on Submit etc.), Document Object Model, Form validation.

Unit V:

Introduction to PHP: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, reading data from web form controls like text boxes, radio buttons, lists etc., Handling File Uploads. Connecting to database (MySQL as reference), executing simple queries, handling results, Handling sessions and cookies File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories.

Text Books:

1. Web Technologies, Uttam K Roy, Oxford University Press.
2. The Complete Reference PHP — Steven Holzner, Tata McGraw-Hill.



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Reference Books:

1. Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dreamtech.
2. Java Server Pages —Hans Bergsten, SPD O'Reilly.
3. Java Script, D.Flanagan
4. Beginning Web Programming-Jon Duckett WROX.



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II Year II Sem	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course are to introduce

- Software life cycle models, Software requirements and SRS document.
- Project Planning, quality control and ensuring good quality software.
- Software Testing strategies, use of CASE tools, Implementation issues, validation & verification procedures.

UNIT I:

Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.

Software Life Cycle Models: Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.

UNIT II:

Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, risk management.

Requirements Analysis and Specification: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT III:

Software Design: Overview of the design process, characterizing a good software design. Layered arrangement of modules, Cohesion and Coupling. approaches to software design.

Agility: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2)

Function-Oriented Software Design: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.

User Interface Design: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT IV:

Coding and Testing: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing, Testing object-oriented programs, Smoke testing, and Some general issues associated with testing.

Software Reliability and Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma.



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UNIT V:

Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.

Software Reuse: reuse- definition, introduction, reason behind no reuse so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

Text Books:

1. Fundamentals of Software Engineering, Rajib Mall, 5th Edition, PHI.
2. Software Engineering: A Practitioner's Approach, Roger S. Pressman, 9th Edition, Mc-Graw Hill International Edition.

Reference Books:

1. Software Engineering, Ian Sommerville, 10th Edition, Pearson.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

e-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105182/>
- 2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview
- 3) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview



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II Year II Sem	COMPUTER NETWORKS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. It provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work

List of Experiments:

1. Study of Network devices in detail and connect the computers in Local Area Network.
2. Write a Program to implement the data link layer framing methods such as
i) Character stuffing ii) bit stuffing.
3. Write a Program to implement data link layer framing method checksum.
4. Write a program for Hamming Code generation for error detection and correction.
5. Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
6. Write a Program to implement Sliding window protocol for Goback N.
7. Write a Program to implement Sliding window protocol for Selective repeat.
8. Write a Program to implement Stop and Wait Protocol.
9. Write a program for congestion control using leaky bucket algorithm
10. Write a Program to implement Dijkstra's algorithm to compute the Shortest path through a graph.
11. Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).



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II Year II Sem	ANDROID APP DEVELOPMENT	L	T	P	C
		0	0	3	1.5

Course Objectives:

- Understand how Android applications work, their life cycle, manifest, Intents, and using external resources
- Design and develop useful Android applications with compelling user interfaces by using, extending, and creating your own layouts and Views and using Menus.
- Secure, tune, package, and deploy Android applications
- Use Android's communication APIs for SMS, telephony, network management, and internet resources (HTTP).

List of Experiments:

1. a) Create an android application to display “welcome” Text Message.
b) Create an android application to display “welcome” Message by using Button.
2. Create an android application to call different activities by using Implicit and Explicit Intents.
3. Create an android application to select item from given list by using Auto Complete Text View (ACTV).
4. Create an android application to display dropdown menu items and pick one item by using Spinner Component.
5. Create an android application to display internal storage data using Array Adapter.
6. Create an android application to display internal storage data in vertical format by using Custom Adapter.
7. Create an android application to display WhatsApp videos in grid view by using Custom Adapter.
8. Create an android application to display webpage by using Web view Component.
9. Create an android application to display different webpages in fragments by using Fragments Component.
10. Create an android application to store the data by using Shared Preferences.
11. Create an android application to demonstrate concept of SQLite Database Storage method.
12. Create an android application to perform different types of operations (Send SMS, Making call and sending email) by using Telephony app.
13. Write an android program to develop Media player application.
14. Write an android program to develop Audio Recording application.
15. Write an android program to develop Video Recording application.
16. Create an android application to get latitude and longitude value by using Location Service.
17. Create an android application to get the notifications on Notification Bar by Using Notification Service.
18. Create an android application to display available Wi-Fi devices and Paired Wi-Fi devices by using Wi-Fi Service.
19. Create an android application to get the Bluetooth devices and list of devices using Bluetooth and Vibrator Service.
20. Create an android application to display current location on Google maps by using Google-Maps Service.



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Reference Books:

1. Android Application Development (with Kitkat Support), Black Book, Pradeep Kothari.
2. Beginning Android 4 Application Development, Wei-Meng Lee.
3. Android Application Development for Dummies, Michael Burton



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II Year II Sem	JAVA PROGRAMMING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

The aim of this course is to

- Practice object-oriented programming in the Java programming language
- implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
- Illustrate inheritance, Exception handling mechanism, JDBC connectivity
- Construct Threads, Event Handling, implement packages

Sample Experiments:

Exercise – 1:

- Write a JAVA program to display default value of all primitive data type of JAVA
- Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise - 2

- Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
- Write a JAVA program to sort for an element in a given list of elements using bubble sort
- Write a JAVA program using String Buffer to delete, remove character.

Exercise - 3

- Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
- Write a JAVA program implements method overloading.
- Write a JAVA program to implement constructor.
- Write a JAVA program to implement constructor overloading.

Exercise - 4

- Write a JAVA program to implement Single Inheritance
- Write a JAVA program to implement multi-level Inheritance
- Write a JAVA program for abstract class to find areas of different shapes

Exercise - 5

- Write a JAVA program give example for “super” keyword.
- Write a JAVA program to implement Interface.
- Write a JAVA program that implements Runtime polymorphism

Exercise - 6

- Write a JAVA program that describes exception handling mechanism
- Write a JAVA program Illustrating Multiple catch clauses
 - Write a JAVA program for creation of Java Built-in Exceptions
 - Write a JAVA program for creation of User Defined Exception



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Exercise - 7

- a) Write a JAVA program that creates threads by extending Thread class. First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds, (Repeat the same by implementing Runnable)
- b) Write a program illustrating **is Alive** and **join ()**
- c) Write a JAVA program that import and use the user defined packages

Exercise – 8

- a) Write a java program that connects to a database using JDBC
- b) Write a java program to connect to a database using JDBC and insert values into it and delete values from it



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II Year II Sem	WEB TECHNOLOGIES LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To implement the web pages using HTML and apply styles.
- Able to develop a dynamic webpage by the use of Java Script.
- Design to create structure of web page, to store the data in web document, and transport information through web.
- Able to write a well formed / valid XML document.

Experiment 1:

Develop static pages (using HTML and CSS) of an online book store. The pages should resemble: www.flipkart.com The website should consist the following pages.

- a) Home page
- b) Registration and user Login
- c) User Profile Page
- d) Books catalog
- e) Shopping Cart
- f) Payment By credit card
- g) Order Conformation

Experiment 2:

Create and save an XML document on the server, which contains 10 users information. Write a program, which takes User Id as an input and returns the user details by taking the user information from the XML document.

Experiment 3:

Write a PHP script that reads data from one file and write into another file.

Experiment 4:

Write a PHP script to print prime numbers between 1-50.

Experiment 5:

Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.

Experiment 6:

Write a PHP script to: a. Find the length of a string. b. Count no of words in a string. c. Reverse a string. d. Search for a specific string.

Experiment 7:

Install TOMCAT web server. Convert the static web pages of assignments 2 into dynamic web pages using servlets and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml. Each user should have a separate Shopping Cart.



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Experiment 8:

Redo the previous task using JSP by converting the static web pages of assignments 2 into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database. Follow the MVC architecture while doing the website.

Experiment 9:

Install a database (Mysql or Oracle). Create a table which should contain at least the following fields: name, password, email-id, phone number (these should hold the data from the registration form). Practice 'JDBC' connectivity. Write a java program/servlet/JSP to connect to that database and extract data from the tables and display them. Experiment with various SQL queries. Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page .

Experiment 10:

Write a JSP which does the following job: Insert the details of the 3 or 4 users who register with the web site (week9) by using registration form. Authenticate the user when he submits the login form using the user name and password from the database.



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III Year – I Sem	INTRODUCTION TO DATA MINING	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course are to

- Understand data mining concepts.
- Learn Data mining techniques and algorithms.
- Comprehend the data mining environments

UNIT – I:

Data Warehousing: Introduction, What is Data Warehouse? Definition, Multidimensional Data Model, OLAP Operations, Warehouse Schema, Data Warehouse Architecture, Warehouse Server, Metadata, OLAP Engine, Data Warehouse Backend Process, Other Features

Data Preprocessing, Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation

UNIT - II

Data Mining: Definitions, KDD vs Data Mining, DBMS vs DM, Other Related Areas, DM Techniques, Other Mining Techniques, Issues and Challenges in DM, DM Applications-Case Studies

Association Rules: definition, Methods to Discover Association Rules, APriori Algorithm, Partition Algorithm, Pincer-Search Algorithm, Dynamic Itemset Counting Algorithms, FP-Tree Growth Algorithm, Discussion on Different Algorithms, Incremental Algorithms, Border Algorithms, Generalized Association Rule, Association Rules with Item Constraints

UNIT - III

Clustering Techniques: Clustering Paradigms, Partitioning Algorithms, k-Medoid Algorithms, CLARA, CLARANS, Hierarchical Clustering, DBSCAN, BIRCH, CURE, Categorical Clustering Algorithms, STIRR, ROCK, CACTUS,

UNIT – IV

Decision Trees: What is a Decision Tree?, Tree Construction Principle, Best Split, Splitting Indices, Splitting Criteria, Decision Tree Construction Algorithms, CART, ID3, C4.5, Decision Tree Construction with Presorting, RainForest, Approximate Methods, CLOUDS, BOAT, Pruning Techniques, Integration of Pruning and Construction, Ideal Algorithm

UNIT – V

Other Techniques: What is a Neural Network?, Learning in NN, Unsupervised Learning, Data Mining Using NN: A Case Study, Genetic Algorithms, Rough Sets, Support Vector Machines
Web Mining: Web Mining, Web Content Mining, Web Structure Mining, Web Usage Mining, Text Mining, Unstructured Text, Episode Rule Discovery for Texts, Hierarchy of Categories, Text Clustering



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Text Books:

1. Data Mining Techniques, Arun K Pujari, University Press
2. Data Mining: Concepts and Techniques, 3rd Edition, Jiawei Han, Micheline Kamber, Jian Pei



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III Year – I Sem	OOAD USING UML	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the Object-based view of Systems
- To develop robust object-based models for Systems
- To explain necessary skills to handle complexity in software design

UNIT- I:

Introduction to UML: The meaning of Object-Oriented, object identity, encapsulation, information hiding, polymorphism, importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture.

UNIT-II:

Basic structural Modeling: Classes, relationships, common mechanisms, diagrams, Advanced structural modeling: advanced relationships, interfaces, types & roles, packages, instances, Class & object diagrams: Terms, concepts, examples, modeling techniques, class & Object diagrams.

UNIT-III:

Collaboration diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration diagrams, iterated messages, use of self in messages, Sequence diagrams: Terms, concepts, differences between collaboration and sequence diagrams, depicting synchronous messages with/without priority call back mechanism, broadcast message.

UNIT- IV:

Behavioral Modeling: Interactions, use cases, use case diagrams, activity diagrams, Advanced Behavioral Modeling: Events and signals, state machines, processes & threads, time and space, state chart diagrams.

UNIT-V:

Architectural Modeling: Terms, concepts, examples, modeling techniques for component diagrams and deployment diagrams.

Text Books:

1. The Unified Modeling Language User Guide, 2nd Edition, Grady Booch, Rumbaugh, Ivar Jacobson, PEA, 2005
2. Fundamentals of Object Oriented Design in UML, 1st Edition, Meilir Page Jones, Addison Wesley, 2000

Reference Books:

1. Head First Object Oriented Analysis & Design, 1st Edition, Mclaughlin, SPD O'Reilly, 2006
2. Object oriented Analysis & Design Using UML, 1st Edition, Mahesh, PHI, 2008
3. The Unified Modeling Language Reference Manual, 2nd Edition, Rumbaugh, Grady Booch, etc., PEA, 2004



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III Year – I Sem	MANAGEMENT INFORMATION SYSTEM	L	T	P	C
		3	0	0	3

Course Objectives

The aim of this course is:

- To describe the role of information technology and decision support systems in business and record the current issues with those of the firm to solve business problems.
- To introduce the fundamental principles of computer-based information systems analysis and design and develop an understanding of the principles and techniques used.
- To enable the students to use information to assess the impact of the Internet and Internet technology on electronic commerce and electronic business and understand the specific threats and vulnerabilities of computer systems.
- To provide the theoretical models used in database management systems to answer business questions.

UNIT–I

Introduction to system and Basic System Concepts, Types of Systems, The Systems Approach, Information System: Definition & Characteristics, Types of information, Role of Information in Decision- Making, Sub-Systems of an Information system: EDP and MIS management levels, EDP/MIS/DSS.

UNIT–II

An overview of Management Information System: Definition & Characteristics, Components of MIS, Frame Work for Understanding MIS: Information requirements & Levels of Management, Simon's Model of decision-Making, Structured Vs Un-structured decisions, Formal vs. Informal systems.

UNIT–III

Developing Information Systems: Analysis & Design of Information Systems: Implementation & Evaluation, Pitfalls in MIS Development.

UNIT–IV

Functional MIS: A Study of Personnel, Financial and production MIS, Introduction to e-business systems, ecommerce – technologies, applications, Decision support systems – support systems for planning, control and decision-making

UNIT-V

Industrial Behavior, formal and informal relationship, Job satisfaction, Change its resistance & management.

Text Books:

1. J.Kanter, “Management/ Information Systems”, PHI.
2. Gordon B.Davis, M.H.Olson, “Management Information Systems– Conceptual foundations, structure and Development”, McGraw Hill.



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Reference Books:

1. James A. O'Brien, "Management Information Systems", Tata McGraw-Hill.
2. James A. Senn, "Analysis & Design of Information Systems", Second edition, McGraw Hill.
3. Robert G. Murdick & Joel E. Ross & James R. Claggett, "Information Systems for Modern Management", PHI.
4. Lucas, "Analysis, Design & Implementation of Information System", McGraw Hill.



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III Year – I Sem	GENERATIVE AI	L	T	P	C
		3	0	0	3

Course Objectives: The objectives of the course are to

- Understand the basics of Generative AI, Text Generation. and the process of generating videos.
- Know about GAN and its variants.

UNIT I :

Introduction To Gen AI: Historical Overview of Generative modeling, Difference between Gen AI and Discriminative Modeling, Importance of generative models in AI and Machine Learning, Types of Generative models, GANs, VAEs, autoregressive models and Vector quantized Diffusion models, Understanding if probabilistic modeling and generative process, Challenges of Generative Modeling, Future of Gen AI, Ethical Aspects of AI, Responsible AI, Use Cases.

UNIT II:

Generative Models For Text: Language Models Basics, Building blocks of Language models, Transformer Architecture, Encoder and Decoder, Attention mechanisms, Generation of Text, Models like BERT and GPT models, Generation of Text, Autoencoding, Regression Models, Exploring ChatGPT, Prompt Engineering: Designing Prompts, Revising Prompts using Reinforcement Learning from Human Feedback (RLHF), Retrieval Augmented Generation, Multimodal LLM, Issues of LLM like hallucination.

UNIT III:

Generation of Images: Introduction to Generative Adversarial Networks, Adversarial Training Process, Nash Equilibrium, Variational Autoencoders, Encoder-Decoder Architectures, Stable Diffusion Models, Introduction to Transformer-based Image Generation, CLIP, Visual Transformers ViT- DALL-E2 and DALL-E3, GPT-4V, Issues of Image Generation models like Mode Collapse and Stability.

UNIT IV:

Generation of Painting, Music, and Play: Variants of GAN, Types of GAN, Cyclic GAN, Using Cyclic GAN to Generate Paintings, Neural Style Transfer, Style Transfer, Music Generating RNN, MuseGAN, Autonomous agents, Deep Q Algorithm, Actor-critic Network.

UNIT V:

Open Source Models And Programming Frameworks: Training and Fine tuning of Generative models, GPT 4 All, Transfer learning and Pretrained models, Training vision models, Google Copilot, Programming LLM, LangChain, Open Source Models, Llama, Programming for TimeSformer, Deployment, Hugging Face.

Text Books:

1. Denis Rothman, “Transformers for Natural Language Processing and Computer Vision”, Third Edition , Packt Books, 2024

Reference Books:

1. David Foster, ”Generative Deep Learning”, O’Reilly Books, 2024.
2. Altaf Rehmani, “Generative AI for Everyone”, BlueRose One, 2024.



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III Year – I Sem	SOCIAL MEDIA MARKETING	L	T	P	C
		3	0	0	3

Course Objectives: The main objectives of the course are to

- Understand about the Social Media and its importance for marketing success.
- Understand the process of integration of different digital media and create marketing content.
- Understand planning & control activities to effectively deliver goods and services.
- Learn principles of marketing, economics, accounting, operations management, and finance.
- Develop and implement social media strategies for B2B and B2C marketing for penetration, growth, and development

Unit I:

Digital marketing overview- what is Digital Marketing, traditional marketing vs. Digital Marketing, understanding traffic, categorization of digital marketing for the business, Legal and Ethical issues, Search Engine Optimization (SEO)- on page optimization, off page optimization.

Unit II:

Social Media overview- Social Media features, social media tools and platforms, Social Media monitoring, Hashtag, viral content. **Social media marketing** - SMM vs. SMO benefits of using SMM social media strategy, Email marketing,

Unit III:

Social media marketing - Facebook marketing-profiles and pages, business categories, Facebook page custom URL, invite page likes, scheduling posts, Facebook events, Facebook insights reports, competitor's Facebook page, connect with twitter. Facebook ad campaigns-adobjective, performance matrix, ad components, Facebook ad structure, Facebook insights, Facebook page promotion, video promotion.

Unit IV:

Google Ads- Introduction to Ad words, keyword planner, Pay-Per-Click(PPC), PPC terminology, PPC AD on Google Facebook.

Unit V:

Content Marketing and security, Security for SMM, Social Media Privacy, Secure Payments and Website Encryption, Cookies, VPN, Digital Certificate, E-Governance, E-wallet.

Text Books:

1. Ryan Deiss, Russ Henneberry (2017) Digital Marketing for Dummies, John Wiley& Sons.
2. Ahuja Vandana (2015) Digital Marketing, Oxford University Press.

Reference Books:

1. Ira Kaufman, Chris Horton (2014) Digital Marketing: Integrating Strategy and Tacticswith Values, A Guidebook for Executives, Managers, and Students, Routledge,
2. Matt Chiera (2018) Digital Marketers Sound Off: Tips, Tactics, Tools, andPredictions from 101 Digital Marketing Specialists, Matt Chiera,
3. Puneet Bhatia (2017) Fundamentals of Digital Marketing, Pearson India, ISBN9352861418, 9789352861415
4. Dan Zarrella (2011) The Social Media Marketing Book, O'Reilly Media.
5. Krista Neher (2013) Visual Social Media Marketing: Harnessing Images, Instagram, Infographics and Pinterest to Grow Your Business Online, Boot Camp Digital



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III Year – I Sem	FOUNDATIONS OF DATA SCIENCE	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course are to provide a practical understanding of the tools and methodologies used in data science, enabling students to extract meaningful insights from data and apply them to real-world problems.

Unit I:

Introduction to Data Science, Evolution of Data Science, Data Science Roles, Stages in a Data Science Project, Applications of Data Science in various fields, Data Security Issues.

Unit II:

Data Collection and Data Pre-Processing: Data Collection Strategies, Data Pre-Processing Overview, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization.

Unit III:

Exploratory Data Analytics Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, Box Plots, Pivot Table, Heat Map, Correlation Statistics, ANOVA.

Unit IV:

Model Development Simple and Multiple Regression, Model Evaluation using Visualization, Residual Plot, Distribution Plot, Polynomial Regression and Pipelines, Measures for In-sample Evaluation, Prediction and Decision Making.

Unit V:

Model Evaluation Generalization Error, Out-of-Sample Evaluation Metrics, Cross Validation, Overfitting, Under Fitting and Model Selection, Prediction by using Ridge Regression, Testing Multiple Parameters by using Grid Search.

Text Books:

1. Cathy O'Neil and Rachel Schutt, "Doing Data Science", O'Reilly.
2. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.

e-resources:

1. https://onlinecourses.swayam2.ac.in/imb23_mg64/preview



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R24 BCA COURSE STRUCTURE AND SYLLABUS

(Applicable for batches admitted from 2024-2025)

III Year – I Sem	E- COMMERCE	L	T	P	C
		3	0	0	3

Course Objectives:

The main objective of the course is to provide a comprehensive understanding of electronic business, including its fundamental principles, technologies, and practical applications, while also equipping students with the skills to analyze, evaluate, and manage online businesses

Unit I:

Introduction to the E-commerce: Meaning and concept, e-commerce versus traditional commerce, Electronic commerce and Physical Commerce, different type of ecommerce, some e-commerce scenario, Advantages of e-commerce. Limitations of e-commerce: technical and non-technical limitations. Model of E-commerce: B2B, B2C, C2B, C2C.

Unit II:

Internet Payment System: Characteristics of payment system, SET Protocol for credit card payment, E-cash, E-check, Micropayment system. E-commerce strategies: Strategies for marketing, Sales and Promotions, Strategies for Purchasing and support activities, Strategies for Web Auctions, Virtual Communities and web portals

Unit III:

E-Business - Introduction: E-Business vs E-commerce, Characteristics of e-Business, e-Business role and their challenges, e-business Requirements, impacts of e-business. E-business strategies: Strategic positioning, Levels of e-business strategies, Strategic planning process, Strategic alignment, the consequences of e-Business, Success factors for implementation of e-business strategies. Business models, Business process and collaborations.

Unit IV:

Integration of Application: Approaches to Middleware, RPC and RMI, Enterprise Application Integration, e-business Integration, loosely Coupled e-Business solutions for integration, Service Oriented Architecture, EAI and web services, web service-security. E-commerce Infrastructure Cluster of Servers, Virtualization Techniques, Cloud computing, Server consolidation using cloud.

Unit V:

E-security: Security on the internet, network and web site risks for e-business, use of firewalls, secure physical infrastructure. The Information Technology Act 2000 and its highlights related to e-commerce.

Text Books:

1. Henry Chan, E-Commerce- Fundamentals and Application, Wiley Publication.
2. David Whiteley, E- Commerce- Strategies, Technology and Applications, Tata McGrawHill



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(Applicable for batches admitted from 2024-2025)

III Year – I Sem	UNIX PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course are to

- Understanding the basic set of commands and utilities in Linux/UNIX systems.
- Learn command structure of LINUX, various types of shells and types of commands and familiarize students with some general commands, directory and file related commands,
- Learn editors available in LINUX and the detailed working on the most Vi editor

Unit I:

Linux introduction and file system - basic features, different flavors of linux. advantages, installing requirement, basic architecture of Unix/Linux system, kernel, shell, linux standard directories. Commands for files and directories cd, ls, cp, md, rm, mkdir, rmdir, pwd, file, more, less.

Unit II:

Creating and viewing files using cat, file comparisons – cmp&comm, view files, disk related commands, checking disk free spaces. Essential Linux commands understanding shells, processes in linux - process fundamentals, connecting processes with pipes, redirecting input output, manual help, background processing.

Unit III:

Managing multiple processes, changing process priority with nice, scheduling of processes at command, cron commands, kill, ps, who, sleep, Printing commands, touch, file related commands -wc, cut, dd, etc. Mathematical commands- bc, expr.

Unit IV:

Creating and editing files with vi& vim editor. Shell programming- Basic of shell programming, Various types of shell available in Linux, comparisons between various shells, shell programming in bash, read command, conditional and looping statements, case statements, parameter passing and arguments, Shell variables, system shell variables, shell keywords, Creating Shell programs for automate system tasks

Unit V:

Simple filter commands – pr, head, tail, cut, paste, sort, uniq, tr. Filter using regular expressions – grep, awk, egrep, and sed.

Text Books:

1. Sumitabha Das "Unix - Concepts & Applications" (Third Ed.) Tata Mcgraw Hill Publications.
2. Graham Glass & King Ables, "Unix for Programmers and Users" (Third Ed.) – Pearson Education India.(Low Prices Edition)

Reference Books:

1. Cristopher Negus "Red Hat Linux 9 Bible" IDG Books India Ltd.
2. Jack T Ackett, David Gunter " Using Linux" PHI, EEE Edition
3. Nicholas Wells "Linux Installation and Administration" Vikas Publishing, New Delhi
4. Yashwant Kanetkar "Unix Shell Programming" BPB Publications,



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III Year – I Sem	DATA MINING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

To make the students practical exposure for various techniques of Data mining

List of Experiments:

Note: Implement the following Data mining techniques in C/C++.

1. Data cleaning techniques
 - a. smoothing by bin means
 - b. smoothing by bin medians
 - c. smoothing by bin boundaries
2. Data Transformation techniques
 - a. Min-Max normalization
 - b. z-score normalization
 - c. Normalization by decimal scaling.
3. Apriori algorithm.
4. Classification techniques
 - a. Bayes classification.
 - b. Nearest Neighbor classification. (NNC)
5. k-means clustering technique.



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III Year – I Sem	OOAD USING UML LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To know the practical issues of the different object oriented analysis and design concepts
- Explain the art of object oriented software analysis and design
- Apply forward and reverse engineering of a software system

Note: For performing the experiments consider any case study (ATM/ Banking / Library /Hospital management systems)

Experiment 1:

Familiarization with Rational Rose or Umbrella environment

Experiment 2:

- a) Identify and analyze events
- b) Identify Use cases
- c) Develop event table

Experiment 3:

- a) Identify & analyze domain classes
- b) Represent use cases and a domain class diagram using Rational Rose
- c) Develop CRUD matrix to represent relationships between use cases and problem domain classes

Experiment 4:

- a) Develop Use case diagrams
- b) Develop elaborate Use case descriptions & scenarios
- c) Develop prototypes (without functionality)

Experiment 5:

- a) Develop system sequence diagrams and high-level sequence diagrams for each use case
- b) Identify MVC classes / objects for each use case
- c) Develop Detailed Sequence Diagrams / Communication diagrams for each use case showing interactions among all the three-layer objects

Experiment 6:

- a) Develop detailed design class model (use GRASP patterns for responsibility assignment)
- b) Develop three-layer package diagrams for each case study

Experiment 7:

- a) Develop Use case Packages
- b) Develop component diagrams
- c) Identify relationships between use cases and represent them
- d) Refine domain class model by showing all the associations among classes

Experiment 8:

Develop sample diagrams for other UML diagrams - state chart diagrams, activity diagrams and deployment diagrams.



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III Year – I Sem	ENGLISH FOR TECHNICAL WRITING	L	T	P	C
		2	0	0	2

Course Objectives:

- Understand that how to improve your writing skills and level of Readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title

UNIT-I:

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT-II:

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts Introduction

UNIT-III: Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT-IV: Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

UNIT-V: Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

Text Books:

1. Writing for Science, 0th Edition, Yale University Press, Goldbort R 2006
2. How to Write and Publish a Scientific Paper, 7th Edition, Cambridge University Press, Day R 2006
3. Handbook of Writing for the Mathematical Sciences, 2nd Edition, SIAM, Highman's book, Highman N 1998



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III Year – II Sem	INTRODUCTION TO CYBER SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

The key objectives of this course include learning core cybersecurity concepts, understanding common cyber threats and vulnerabilities, and exploring basic security measures for protecting systems and data

UNIT-I:

Concept of Cyberspace: Netizens Technology, Law and Society Object, Scope of the Information Technology Act 2000, Electronic Records and Electronic Commerce. Intrusion Detection System, Intrusion Prevention System, Public Key Infrastructure.

UNIT-II:

Internet Security: Computer Security and Threats, Hacking, Cracking, sneaking, Viruses, Trojan Horses, malicious code, Worms and Logic Bombs. Network attack and Defense Most Common Attacks, Scripts Kiddies and Packaged Defense.

UNIT-III:

Wireless Network Security: Wireless Network Components, Security issues in Wireless Networks, Securing a Wireless Network, Mobile Security, The Smartphone Pentest Framework

UNIT-IV:

Cyber Laws and Standards: ISO 27001, Cyber Law (Information Technology Act 2000), International Standards maintained for Cyber Security, Security Audit, Investigation by Investing Agency, Cyber Security Solutions

UNIT-V:

Security Management: Disaster Recovery, Digital Signature, Ethical Hacking, Penetration Testing, Computer Forensics

Text Books:

1. GautamKumawat, Ethical Hacking & Cyber Security Course : A Complete Package, Udemy Course, 2017
2. Georgia Weidman , Penetration testing A Hands-On In t r o d u c t i o n to Hacking, no starch press, 2014

Reference Books:

1. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition , Pearson Education , 2015
2. William Stallings-Cryptography and Network Security: Principles and Practice Publication



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III Year – II Sem	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

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

- To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
- To compare and differentiate organization structures and project structures
- To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

UNIT-I:

Conventional Software Management: The waterfall model, conventional software Management performance.

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

UNIT-II:

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT- III:

Model based software architectures: A Management perspective and technical perspective.

Work Flows of the process: Software process workflows, Iteration workflows.

Checkpoints of the process: Majormile stones, Minor Milestones, Periodic status assessments.

UNIT- IV:

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

UNIT-V:

Agile Methodology, ADAPting to Scrum, Patterns for Adopting Scrum, Iterating towards Agility. **Fundamentals of DevOps:** Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes



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Text Books:

1. Software Project Management, Walker Royce, PEA, 2005.
2. Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
3. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.

Reference Books:

1. Software Project Management, Bob Hughes,3/e, Mike Cotterell, TMH
2. Software Project Management, Joel Henry, PEA
3. Software Project Management in practice, Pankaj Jalote, PEA, 2005,
4. Effective Software Project Management, Robert K.Wysocki, Wiley,2006.
5. Project Management in IT, Kathy Schwalbe, Cengage



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III Year – II Sem	MACHINE LEARNING	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of this course are

- Learn the basics of machine learning and importance of feature engineering
- Understand the foundational rules of probability, Study different classification and clustering techniques and understand the basics of neural networks concepts

UNIT-I:

Introduction to Machine Learning: Introduction, what is human learning, types of human learning, what is machine learning, types of machine learning, problems not to be solved using machine learning, Applications of machine learning, Tools in machine learning, Issues in machine learning Preparing to Model: Machine learning activities, Basic types of data in machine learning, Exploring structure of data, Data quality and remediation, Data Preprocessing

UNIT-II:

Modelling and Evaluation: Selecting a model, training a model, Model representation and Interpretability, Evaluating Performance of a model, Improving performance of a model. Basics of Feature Engineering: Introduction, Feature transformation, Feature subset selection

UNIT-III:

Brief Overview of Probability: Importance of Statistical Tools in Machine Learning, Concept of Probability, Random Variables, Some Common Discrete Distributions, Some Common Continuous Distributions, Multiple Random Variables, Sampling Distributions, Hypothesis Testing. Bayesian Concept Learning: Why Bayesian methods are important, Bayes Theorem, Concept Learning, Bayesian Belief Network

UNIT-IV:

Supervised Learning : Classification: Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms Supervised Learning : Regression: Example of Regression, Common Regression Algorithms Unsupervised Learning: Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering, Finding Pattern using Association Rule

UNIT-V:

Basics of Neural Network: Understanding Biological Neuron, Exploring the Artificial Neuron, Types of Activation Functions, Early Implementations of ANN, Architectures of Neural Network, Learning Process in ANN, Back Propagation, Deep Learning

Other Types of Learning: Representation Learning, Active Learning Vs Memory based Learning, Ensemble Learning Algorithm

Text Books:

1. Machine Learning, Pearson by Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das
2. Introduction to Machine Learning with Python: A Guide for Data Scientists by Andreas C. Muller & Sarah Guido



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Reference Books:

1. Machine Learning for Absolute Beginners, 2nd Edition by Oliver Theobald
2. Machine Learning for Dummies: IBM Limited Edition by Judith Hurwitz and Daniel Kirsch



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III Year – II Sem	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course are to gain knowledge of IoT architecture, communication protocols, hardware and software components, and developing practical skills in building and deploying IoT solutions.

Unit I:

Introduction to IoT: Genesis of IoT, IoT and Digitization, IoT Challenges, Comparing IoT architectures, a simplified IoT architecture, The core IoT functional Stack, IoT data management and compute stack.

Unit II:

Engineering for IoT Networks: Sensors, Actuators, Smart Objects, Sensor Networks, IoT Access Technologies, IP as the IoT Network Layer, Applications protocols for IoT.

Unit III:

Data and Analytics for IoT: An introduction to data analytics for IoT, Machine Learning, Big data analytics tools and technology, edge streaming analytics, network analytics

Unit IV:

Cloud storage models and Communication APIs of IoT Systems, IoT Security Challenges, IoT System's Security Practices

Unit V:

IoT in Industry: Manufacturing, Oil and Gas, Utilities, Smart and Connected Cities, Transportation, Mining, Public Safety.

Text Books:

1. D. Hanes, G. Salgueiro, P. Grossetete, R. Barton, J. Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, CISCO.
2. Rajkamal, Internet of Things, McGraw Hill Education.

Reference Books:

1. Arshdeep Bahga, Vijay Madiseti, "Internet of Things (A Hands-on-Approach)", University Press India Pvt. Ltd.

e-resources:

1. <https://nptel.ac.in/courses/106105166>



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III Year – II Sem	BIG DATA TECHNOLOGIES	L	T	P	C
		2	0	0	2

Course objectives:

The main objective of this course is to implement MapReduce programs for processing big data, realize storage and processing of big data using MongoDB, Pig, Hive and Spark and analyze big data using machine learning techniques.

UNIT I:

Classification of data, Characteristics, Evolution and definition of Big data, What is Big data, Why Big data, Traditional Business Intelligence Vs Big Data, Typical data warehouse and Hadoop environment. Big Data Analytics: What is Big data Analytics, Classification of Analytics, Importance of Big Data Analytics, Technologies used in Big data Environments, Few Top Analytical Tools, NoSQL, Hadoop.

TB1: Ch 1: 1.1, Ch2: 2.1-2.5, 2.7, 2.9-2.11, Ch3: 3.2, 3.5, 3.8, 3.12, Ch4: 4.1, 4.2

UNIT II:

Introduction to Hadoop: Introducing hadoop, Why hadoop, Why not RDBMS, RDBMS Vs Hadoop, History of Hadoop, Hadoop overview, Use case of Hadoop, HDFS (Hadoop Distributed File System), Processing data with Hadoop, Managing resources and applications with Hadoop YARN (Yet Another Resource Negotiator). Introduction to Map Reduce Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression.

TB1: Ch 5: 5.1-5.8, 5.10-5.12, Ch 8: 8.1 - 8.8

UNIT III:

Introduction to MongoDB: What is MongoDB, Why MongoDB, Terms used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.

TB1: Ch 6: 6.1-6.5

UNIT IV:

Introduction to Hive: What is Hive, Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF). Introduction to Pig: What is Pig, Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use case for Pig, Pig Latin Overview, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User Defined Function, Pig Vs Hive.

TB1: Ch 9: 9.1-9.6, 9.8, Ch 10: 10.1 - 10.15, 10.22

UNIT V:

Spark and Big Data Analytics: Spark, Introduction to Data Analysis with Spark. Text, Web Content and Link Analytics: Introduction, Text Mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and Analyzing a Web Graph.

TB2: Ch5: 5.2, 5.3, Ch 9: 9.1-9.4



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Text Books:

1. Seema Acharya, Subhashini Chellappan “Big data and Analytics” Wiley India Publishers, 2nd Edition, 2019.
2. Rajkamal, Preeti Saxena, “Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning” , McGraw Hill Publication, 2019

Reference Books:

1. Adam Shook and Donald Mine, “MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems” - O'Reilly 2012
2. Tom White, “Hadoop: The Definitive Guide” 4th Edition, O'reilly Media, 2015.
3. Thomas Erl, Wajid Khattak, and Paul Buhler, Big Data Fundamentals: Concepts, Drivers & Techniques, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016
4. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy -Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, MIT Press 2020, 2nd Edition

e-Resources:

- <https://www.kaggle.com/datasets/grouplens/movielens-20m-dataset>
- <https://www.youtube.com/watch?v=bAyrObl7TYE&list=PLEiEAq2VkUUJqp1kg5W1mo37urJQOdCZ>
- <https://www.youtube.com/watch?v=VmO0QgPCbZY&list=PLEiEAq2VkUUJqp1kg5W1mo37urJQOdCZ&index=4>
- <https://www.youtube.com/watch?v=GG-VRm6XnNk>
- https://www.youtube.com/watch?v=JglO2Nv_92A



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III Year – I Sem	RESEARCH METHODOLOGY	L	T	P	C
		2	0	0	2

Course objectives:

- To understand the objectives and characteristics of a research problem.
- To analyze research related information and to follow research ethics
- To understand the types of intellectual property rights.
- To learn about the scope of patent rights.
- To understand the new developments in IPR.

UNIT - I

Research problem: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT - II

Literature study: Effective literature studies approaches, analysis Plagiarism, Research ethics, Technical writing: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT - III

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT - IV

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT - V

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc, Traditional knowledge Case Studies, IPR and IITs

Text Books:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”

References Books:

1. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
2. Mayall, “Industrial Design”, McGraw Hill, 1992.
3. Niebel, “Product Design”, McGraw Hill, 1974.



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4. Asimov, “Introduction to Design”, Prentice Hall, 1962.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New TechnologicalAge”, 2016.
6. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008



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IV Year – I Sem	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	1	0	4

Course Objectives:

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

- Understand, analyze and denote time complexities of algorithms
- Introduce the different algorithmic approaches for problem solving through numerous example problems
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them.
- Provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness

UNIT I:

Introduction: Algorithm- introduction, Algorithm characteristics, Pseudo code Conventions Recursive Algorithm, Performance Analysis, Space Complexity, Time Complexity, Probabilistic Complexity, Asymptotic Notations, Practical Complexities, Big and little- O notations.

UNIT II:

Divide and Conquer: General Method, Defective chessboard, Binary Search, finding the maximum and minimum, Merge sort, Quick sort. The Greedy Method: The general Method, knapsack problem, Job sequencing with deadlines, minimum-cost spanning Trees, Optimal Merge Patterns, Single Source Shortest Paths.

UNIT III:

Dynamic Programming: General Method, Travelling Sales Person Problem, 0/1 Knapsack Problem, Optimal Binary Search Tree, Matrix Chain Multiplication, All pairs-shortest paths Floyd-Warshall algorithm for shortest path, String Editing, Reliability Design,.

UNIT IV:

Backtracking: The General Method, The 8-Queens problem, sum of subsets, Graphcoloring, Hamiltonian cycles, knapsack problem.

Branch and Bound: The Method, Least cost (LC) Search, The 15- Puzzle: an Example, Control Abstraction for LC-Search.

UNIT V:

Bounding, FIFO Branch and-Bound, LC Branch and Bound, 0/1 Knapsack Problem, Traveling Salesperson problem, Introduction to NP-Hard and NP- Completeness - Decision Trees - P, NP and NP – Complete Problems - Cook's theorem.

Text Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press.
2. Introduction to Algorithms Thomas H. Cormen, PHI Learning



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Reference Books:

1. Harsh Bhasin, “Algorithms Design & Analysis”, Oxford University Press.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, “The Design and Analysis of Computer Algorithms”, Pearson Education India, 1 January 2004.
3. S. Sridhar, “Design and Analysis of Algorithms”, Oxford University Press.



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R24 BCA COURSE STRUCTURE AND SYLLABUS

(Applicable for batches admitted from 2024-2025)

IV Year – I Sem	CRYPTOGRAPHY & NETWORK SECURITY	L	T	P	C
		3	1	0	4

Course Objectives:

The main objectives of this course are to explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, public key algorithms, design issues and working principles of various authentication protocols and various secure communication standards including IPsec, and SSL/TLS.

UNIT I:

Basic Principles: Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography- integer arithmetic, modular arithmetic, matrices, linear congruence.

UNIT II:

Symmetric Encryption: Mathematics of Symmetric Key Cryptography-algebraic structures, $GF(2^n)$ Fields, Introduction to Modern Symmetric Key Ciphers-modern block ciphers, modern stream ciphers, DES, Double DES, Triple DES, AES

UNIT III:

Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography-primes, primality testing, factorization, CRT, Asymmetric Key Cryptography- RSA crypto system, Rabin cryptosystem, Elgamal Crypto system, ECC

UNIT IV:

Data Integrity, Digital Signature Schemes & Key Management: Message Integrity and Message Authentication-message integrity, Random Oracle model, Message authentication, Cryptographic Hash Functions-whirlpool, SHA-512, Digital Signature- process, services, attacks, schemes, applications, Key Management-symmetric key distribution

UNIT V:

Network Security-I: Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, **Network Security-II :** Security at the Network Layer: IPSec-AH and ESP protocols, Malicious software, worms, viruses, IDS, Firewalls.

Text Books:

1. Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill,2015
2. Cryptography and Network Security,4th Edition, William Stallings, (6e) Pearson,2006
3. Everyday Cryptography, 1st Edition, Keith M.Martin, Oxford,2016

Reference Books:

1. Network Security and Cryptography, 1st Edition, Bernard Meneges, Cengage Learning,2018



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IV Year – I Sem	DATA ANALYSIS WITH POWER BI	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course are to

- Gain a solid understanding of what Power BI is and how it fits into the world of data analysis and visualization.
- Learn how to import, clean, and transform data from various sources to make it suitable for analysis in Power BI.
- Master the art of creating data models in Power BI, including defining relationships between tables and creating calculated columns and measures.
- Develop the skills to create compelling and interactive data visualizations, such as charts, graphs, maps, and tables, to convey insights effectively.
- Learn to build interactive dashboards and reports that provide a clear and actionable view of data.

UNIT I:

Introduction to Power BI: Overview of Business Intelligence (BI), Introduction to Power BI and its components, Installing and setting up Power BI Desktop.

Data Preparation and Transformation: Connecting to various data sources(e.g. Databases, Excel, Web services), Data loading and transformation using Power Query Editor, Data cleansing and shaping techniques

UNIT II:

Data Modeling: Understanding data models in Power BI, Creating relationships between tables, DAX (Data Analysis Expressions) basics for calculations.

Data Visualization: Building basic visualizations (e.g., charts, tables, matrices), Customizing and formatting visuals, Creating interactive reports and dashboards.

UNIT III:

Advanced Data Modeling and DAX: Advanced DAX functions for complex calculations, Time intelligence calculations, Measures and calculated columns.

UNIT IV:

Power BI Service and Data Sharing: Publishing reports to Power BI Service, Sharing and Collaboration options, Power BI Mobile app usage. Data Security and Governance: Role-level security in Power BI, Data lineage and auditing, Best practices for data governance.

UNIT V:

Advanced Topics: Power Query M language for advance data transformations, Custom visuals and extensions, Power BI integration with other tools (e.g., Azure, SharePoint)



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Text Books:

1. "Power BI Step-by-Step" by Mr. Grant Gamble
2. "Analyzing Data with Power BI and Power Pivot for Excel" by Alberto Ferrari and Marco Russo
3. "Power BI Cookbook" by Brett Powell
4. "Power BI for Data Science" by Debarchan Sarkar and Brett Powell

Reference Books;

1. "The Definitive Guide to DAX: Business intelligence for Microsoft Power BI, SQL Server Analysis Services, and Excel" by Alberto Ferrari and Marco Russo
2. "Power BI Desktop and the Power BI Service: Business Intelligence with Power Pivot and Power Query" by Ken Getz and Michael Alexander
3. "Dashboarding and Reporting with Power BI Desktop and Excel" by Paul Turley



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IV Year – I Sem	BLOCKCHAIN FOUNDATIONS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course are to provide a comprehensive understanding of blockchain technology, including its underlying principles, architecture, and applications

Unit I:

Why Blockchain Technology, Blockchain Bitcoin Blockchain, Blockchain Architecture, Conceptualization, Blockchain components, Cryptocurrencies, Characteristics of cryptocurrencies, Alt coins, Crypto wallets, Creation of Blocks, Wallet Transactions, Transaction details in a Block, Merkle Tree, Hash functions, pseudo random numbers, Puzzle friendly and collision resistant hash, public key cryptosystem, Generation of keys, Digital signatures, Zero-knowledge systems

Unit II:

Blockchain types-Public Blockchain, Private Blockchain, Federated Blockchain, Permissionless, Permissioned Blockchain Networks, Ethereum blockchain, Go Ethereum, Gas, Gas price, Gas Limit, ETH, MetaMask, Public Test Networks, set up a Ethereum node using Geth.

Unit III:

Mining in Blockchain, Steps in Mining, Double spending, Consensus protocols, PoW, Hashcash, Attacks on Bitcoin, Sybil Attacks, 51% Attack, eclipse attacks, DDoS Attacks, Replay Attacks, Byzantine fault, node failure.

Unit IV:

Proof of Stake, Difference between PoW vs PoS, Byzantine General Problem, BFT (Byzantine fault tolerance), PBFT (Practical Byzantine fault tolerance), Delegated Proof of Stack, Paxos Consensus algorithm, Raft Algorithm, Solo Miner, Pool Miners, Smart contracts in Blockchain, Solidity, Data types in solidity, Operators, State variables, Global Variables, Local variables.

Unit V:

Remix, Compilation of smart contracts, Deployment environments, JavaScript Environment, Injected Web3, Web3 Provider, Solidity arrays, Solidity functions, Structs in solidity, Inheritance, Special variables, Solidity mapping, Function overloading, Personal Blockchain network, Ganache, Contract deployment to Ganache network, Modifiers in solidity, Events.

Text Books:

1. Bettina Warburg, Bill Wanger and Tom Serres, Basics of Blockchain, Independently published.
2. Holbrook and Joseph, Architecting enterprise blockchain solutions, John Wiley & Sons.



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Reference Books:

1. Bashir and Imran, Mastering blockchain: “Distributed ledger technology, decentralization, and smart contracts explained, Packt Publishing Ltd.
2. Pathak, Nishith and Anurag Bhandari, IoT, AI, and Blockchain for. NET: Building a Next Generation Application from the Ground Up, Apress.



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IV Year – I Sem	COMPILER DESIGN	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course are to understand the basic concept of compiler design, and its different phases which will be helpful to construct new tools like LEX, YACC, etc.

UNIT I:

Lexical Analysis: Language Processors, Structure of a Compiler, Lexical Analysis, The Role of the Lexical Analyzer, Bootstrapping, Input Buffering, Specification of Tokens, Recognition of Tokens, Lexical Analyzer Generator-LEX, Finite Automata, Regular Expressions and Finite Automata, Design of a Lexical Analyzer Generator.

Syntax Analysis: The Role of the Parser, Context-Free Grammars, Derivations, Parse Trees, Ambiguity, Left Recursion, Left Factoring,

UNIT II:

Top Down Parsing: Pre Processing Steps of Top Down Parsing, Backtracking, Recursive Descent Parsing, LL (1) Grammars, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing.

Bottom Up Parsing: Introduction, Difference between LR and LL Parsers, Types of LR Parsers, Shift Reduce Parsing, SLR Parsers, Construction of SLR Parsing Tables, More Powerful LR Parsers, Construction of CLR (1) and LALR Parsing Tables, Dangling Else Ambiguity, Error Recovery in LR Parsing, Handling Ambiguity Grammar with LR Parsers.

UNIT III:

Syntax Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's. **Intermediate Code Generation:** Variants of Syntax Trees, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Backpatching, Intermediate Code for Procedures.

UNIT IV:

Code Optimization: The Principle Sources of Optimization, Basic Blocks, Optimization of Basic Blocks, Structure Preserving Transformations, Flow Graphs, Loop Optimization, Data-Flow Analysis, Peephole Optimization

UNIT V:

Run Time Environments: Storage Organization, Run Time Storage Allocation, Activation Records, Procedure Calls, Displays

Code Generation: Issues in the Design of a Code Generator, Object Code Forms, Code Generation Algorithm, Register Allocation and Assignment.

Text Books:

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Pearson, 2007.



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Reference Books:

1. Compiler Construction, Principles and Practice, Kenneth C Loudon, Cengage Learning, 2006
2. Modern compiler implementation in C, Andrew W Appel, Revised edition, Cambridge University Press.



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IV Year – I Sem	SOFTWARE TESTING	L	T	P	C
		3	0	0	3

Course Objectives:

Student will gain an understanding of Selenium basics. Student will practice writing tests for a variety of quality intent, including code coverage, defect finding, and statistical testing using Selenium.

UNIT-I

Selenium Basics: Software Testing, Automation Testing, Introduction to Selenium and its Components, Selenium IDE Features, Selenium Download and Installation, Creating Scripts using Firebug and Its Installation, Locator Types

UNIT-II

Selenium WebDriver: Selenium WebDriver Installation with Eclipse, Handling Dropdowns, Explicit and Implicit Wait, Handling Alerts/Pop-ups, Handling Web Tables, Frames, Dynamic Elements, Robot API, AutoIT

UNIT-III

Selenium Framework: Test Automation Framework: Introduction, Benefits of Automation Framework, Types of Automation framework

UNIT-IV

Introduction to TestNG,: TestNG Framework, TestNG installation, TestNG Annotations and Listeners, TestNG Example, TestNG Process Execution: Batch, Controlled Batch & Parallel

UNIT-V

Advance Selenium: Selenium Grid: Introduction, Usage of Selenium Grid, Grid1.0 vs Grid2.0, Selenium Grid architecture, How to setup Selenium Grid using command line, designing test scripts that can run on the Grid, Using Desired Capabilities Object, Using Remote Web Driver Object, Running a sample Test Case on the Grid

Text Books:

1. Test Automation using Selenium WebDriver with Java: Step by Step Guide by Navneesh Garg
2. Selenium WebDriver_ From Foundations To Framework by Yuzun Liang & Alex Collins

Reference Books:

1. Absolute Beginner Java 4 Selenium Webdriver: Come Learn How to Program for Automation Testing by Rex Allen Jones II

e-resources:

1. <https://www.softwaretestingmaterial.com/types-test-automation-frameworks/>



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IV Year – I Sem	NETWORK PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course are to develop skills in building client-server applications, understanding network communication concepts like TCP/IP and sockets, and analyzing network protocols and their performance

UNIT I:

Introduction to Network Programming: Introduction to Network Programming: OSI model, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application
Elementary Sockets: Sockets introduction, Elementary TCP sockets.

UNIT II:

TCP client server: Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host.

UNIT III:

UDP and Socket options: Elementary UDP sockets: Introduction UDP Echo server functions, lost datagram, summary of UDP example, Lack of flow control with UDP. Socket options: getsockopt and setsockopt functions. Socket states, Generic socket options IPV4 socket options, IPV6 socket options, ICMPV6 socket options and TCP socket options, SCTP socket options, fcntl function.

UNIT IV:

Advanced Sockets and Daemon Processes: IPV4 and IPV6 interoperability, introduction, IPV4 client:IPV6 server, IPV6 client: IPV4 Server, IPV6 Address-testing macros. Daemon Processes and inetdSuperserver –Introduction, syslogd Daemon, syslog Function, daemon_init Function, inetdDaemon, daemon_inetd. Advanced I/O functions: Socket timeouts, recv and send functions, ready and writev functions, recvmsg and send msg functions, Ancillary data.

UNIT V:

Broadcasting and Multicasting: Broadcasting introduction, broadcast addresses, unicast versus Broadcast, dg_cli function using broadcasting, race conditions, Multicasting addresses, multicasting versus broadcasting on a LAN, multicasting on a WAN, source-specific multicast, multicast socket options. Raw Sockets: Introduction, Raw Socket Creation, Raw Socket Output, Raw Socket Input, Ping Program, Traceroute Program.

Text Books:

1. UNIX Network Programming, by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Pearson Education
2. UNIX Network Programming, 1st Edition, W. Richard Stevens. PHI.

Reference Books:

1. UNIX Systems Programming using C++ T CHAN, PHI.



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2. UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education
3. Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education



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IV Year – I Sem	CRYPTOGRAPHY & NETWORK SECURITY LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

The main objective of this course is to implement various encryption and decryption mechanisms

List of Experiments:

Experiment 1:

1. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and displays the result.

Experiment 2:

2. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.

Experiment 3:

3. Write a Java program to perform encryption and decryption using the following algorithms
 - a. Ceaser cipher
 - b. Substitution cipher
 - c. Hill Cipher

Experiment 4:

4. Write a C/JAVA program to implement the DES algorithm logic.

Experiment 5:

5. Write a C/JAVA program to implement the Blowfish algorithm logic.

Experiment 6:

6. Write a C/JAVA program to implement the Rijndael algorithm logic.

Experiment 7:

7. Write the RC4 logic in java Using Java cryptography; encrypt the text "Hello world" using Blowfish. Create your own key using Java key tool.

Experiment 8:

1. Write a Java program to implement RSA algorithm.

Experiment 9:

2. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.

Experiment 10:

3. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

Experiment 11:

4. Calculate the message digest of a text using the MD5 algorithm in JAVA.



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IV Year – I Sem	NETWORK PROGRAMMING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

The main objectives of this course are to

- Write socket API based programs
- Design and implement client-server applications using TCP and UDP sockets
- Analyze network programs

List of Experiments

1. Implement programs for Inter Process Communication using PIPE, Message Queue and Shared Memory.
2. Write a programme to create an integer variable using shared memory concept and increment the variable simultaneously by two processes. Use semaphores to avoid race conditions.
3. Design TCP iterative Client and server application to reverse the given input sentence
4. Design TCP iterative Client and server application to reverse the given input sentence
5. Design TCP client and server application to transfer file
6. Design a TCP concurrent server to convert a given text into upper case using multiplexing system call “select”
7. Design a TCP concurrent server to echo given set of sentences using poll functions
8. Design UDP Client and server application to reverse the given input sentence
9. Design UDP Client server to transfer a file
10. Design using poll client server application to multiplex TCP and UDP requests for converting a given text into upper case.
11. Design a RPC application to add and subtract a given pair of integers

Text Books:

1. UNIX Network Programming, by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Pearson Education.
2. UNIX Network Programming, 1 st Edition, - W. Richard Stevens. PHI



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IV Year – II Sem	RESOURCE MANAGEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course are to equip learners with the skills to effectively plan, allocate, and utilize resources (like people, equipment, and finances) to achieve organizational goals, improve project performance, and optimize resource utilization

Unit I:

Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem: Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, big-M method, two-phase method, degeneracy and unbound solutions, Free slack, Total slack, Crashing, Resource allocation.

Unit II:

Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the steppingstone method and MODI method. Assignment Problem: Formulation, Hungarian method for optimal solution. Solving unbalanced problem. Traveling salesman problem as assignment problem

Unit III:

Sequencing models: Solution of Sequencing Problem, Processing n Jobs through 2 Machines, Processing n Jobs through 3 Machines, Processing 2 Jobs through m machines, Processing n Jobs through m Machines.

Unit IV:

Dynamic programming: Characteristics of dynamic programming, Dynamic programming approach for Priority Management, Employment Smoothing, Capital Budgeting, Stagecoach/Shortest Path, Cargo Loading and Reliability problems

Unit V:

Simulation: Advantages of Simulation, Limitations of Simulation, Monte-Carlo Simulation, Random Numbers. CPM and PERT: Drawing of networks, Removal of redundancy, Network computations bang, Sandwich.

Text Books:

1. Rader, D. J., Deterministic Operations Research: Models and Methods in Linear Optimization, J. Wiley & Sons.
2. Taha, H. A., Operations Research, Pearson

Reference Books:

1. P. Sankaralyer, "Operations Research", Tata McGraw-Hill.
2. J K Sharma., "Operations Research Theory & Applications", Macmillan India Ltd.



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e-resources:

1. <https://nptel.ac.in/courses/110/106/110106062/>
2. <https://nptel.ac.in/courses/111/107/111107128/>
3. <https://nptel.ac.in/courses/112/106/112106134/>



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IV Year – II Sem	SEARCH ENGINE OPTIMIZATION	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course are to understand basics of SEO and how search engines work, learn the steps that are needed to prepare for, execute, and evaluate SEO initiatives.

Unit I:

Introduction to The Search Engines , The Mission of Search Engines, The Market Share of Search Engines, The Human Goals of Searching, Determining Searcher Intent: A Challenge for Both Marketers and Search Engines. How People Search, How Search Engines Drive Commerce on the Web, Eye Tracking: How Users Scan Results Pages, Click Tracking: How Users Click on Results, Natural Versus Paid. Search Engine Basics: Understanding Search Engine Results, Algorithm-Based Ranking Systems: Crawling, Indexing, and Ranking, Determining Searcher Intent and Delivering Relevant, Fresh Content, Analyzing Ranking Factors, Using Advanced Search Techniques, Vertical Search Engines, Country-Specific Search Engines

Unit II:

Determining SEO Objectives and Defining Site's Audience: Setting SEO Goals and Objectives, Developing an SEO Plan Prior to Site Development, Understanding Audience and Finding Niche, SEO for Raw Traffic, SEO for E-Commerce Sales, SEO for Mindshare/Branding, SEO for Lead Generation and Direct Marketing, SEO for Reputation Management, SEO for Ideological Influence.

First Stages of SEO: The Major Elements of Planning, Identifying the Site Development Process and Players, Defining Site's Information Architecture, Auditing an Existing Site to Identify SEO Problems, Identifying Current Server Statistics Software and Gaining Access, Determining Top Competitors, Assessing

Historical Progress, Benchmarking Current Indexing Status Benchmarking Current Rankings, Benchmarking Current Traffic Sources and Volume, Leveraging Business Assets for SEO, Combining Business Assets and Historical Data to Conduct SEO/Website SWOT Analysis

Unit III:

Keyword Research: The Theory Behind Keyword Research, Traditional Approaches: Domain Expertise, Site Content Analysis, Keyword Research Tools, Determining Keyword Value/Potential ROI, Leveraging the Long Tail of Keyword Demand, Trending, Seasonality, and Seasonal Fluctuations in Keyword Demand

Unit IV:

Developing an SEO-Friendly Website: Making Site Accessible to Search Engines, Creating an Optimal Information Architecture, Root Domains, Subdomains, and Microsites, Optimization of Domain Names/URLs, Keyword Targeting, Content Optimization, Duplicate Content Issues Controlling Content with Cookies and Session IDs, Content Delivery and Search Spider Control, Redirects, Content Management System (CMS) Issues, Optimizing Flash, Best Practices for Multilanguage/Country Targeting.



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Unit V:

Optimizing for Vertical Search: The Opportunities in Vertical Search, Optimizing for Local Search, Optimizing for Image Search, Optimizing for Product Search, Optimizing for News, Blog, and Feed Search, Others: Mobile, Video/Multimedia Search.

Tracking Results and Measuring Success: Why Measuring Success Is Essential to the SEO Process, Measuring Search Traffic, Tying SEO to Conversion and ROI, Competitive and Diagnostic Search Metrics, Key Performance Indicators for Long Tail SEO

Text Books:

1. Eric Enge, Stephan Spencer, Rand Fishkin, Jessie C Stricchiola, “The Art of SEO : Mastering Search Engine Optimization”, O'Reilly Media, October, 2009

Reference Books:

1. David Amerland, Google Semantic Search, Pearson
2. Jerri L. Ledford, “SEO: Search Engine Optimization Bible”, 2nd Edition, Wiley India, April, 2009
3. John I Jerkovic, “SEO Warrior: Essential Techniques for Increasing Web Visibility”, O'Reilly



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IV Year – II Sem	QUANTUM SCIENCE & TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives: The main objectives of the course are to

- Introduce fundamental concepts of quantum mechanics and its mathematical formalism.
- Explore quantum computing and communication principles and technologies.
- Understand the physical implementation and limitations of quantum systems.
- Enable students to relate quantum theory to practical applications in computing, cryptography, and sensing.
- Familiarize students with the emerging trends in quantum technologies.

Unit I:

Fundamentals of Quantum Mechanics: Historical background: Blackbody radiation, photoelectric effect, and Compton scattering; Dual nature of light and matter; De Broglie hypothesis; Schrödinger equation; Free particle, infinite potential well, step potential; Operators and observables: position, momentum, Hamiltonian;

Unit II:

Quantum Information Theory: Classical vs. quantum information; Qubit representation using Bloch sphere; Quantum superposition and quantum entanglement; Dirac notation (bra-ket), tensor products, and composite systems; Bell states and EPR paradox; Quantum gates: Pauli-X, Y, Z; Hadamard; Phase; T; CNOT; Quantum circuit models and notation;

Unit III: Quantum Computing: Classical computing review and limitations; Quantum parallelism and interference; Deutsch and Deutsch-Jozsa algorithms; Grover's search algorithm, Oracle and amplitude amplification; Shor's factoring algorithm (overview and significance);

Unit IV:

Quantum Fourier Transform (QFT); Quantum error correction: Bit-flip, phase-flip, and Shor's 9-qubit code; Introduction to quantum programming: Qiskit, Cirq, IBM Quantum Experience (overview)

Unit V:

Quantum Technologies and Applications: Quantum sensors: magnetometry, gravimetry; Quantum metrology: standard time, atomic clocks; Quantum imaging and lithography; Hardware platforms: Superconducting qubits, Trapped ions, Photonic quantum processors; Quantum supremacy and NISQ era; Global initiatives: IBM, Google, D-Wave, IonQ, India's NQM; Ethical concerns and future prospects

Text Books:

1. "Quantum Computation and Quantum Information", Michael A. Nielsen, Isaac L. Chuang
2. "Quantum Mechanics: Concepts and Applications", Nouredine Zettili



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IV Year – II Sem	DEVOPS	L	T	P	C
		2	0	0	2

Course Objectives:

The main objectives of this course are to:

- Describe the agile relationship between development and IT operations.
- Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
- Implement automated system update and DevOps lifecycle.

UNIT-I

Introduction to DevOps: Introduction to SDLC, Agile Model. Introduction to Devops. DevOps Features, DevOps Architecture, DevOps Lifecycle, Understanding Workflow and principles, Introduction to DevOps tools, Build Automation, Delivery Automation, Understanding Code Quality, Automation of CI/ CD. Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

UNIT-II

Source Code Management (GIT): The need for source code control, The history of source code management, Roles and code, source code management system and migrations. What is Version Control and GIT, GIT Installation, GIT features, GIT workflow, working with remote repository, GIT commands, GIT branching, GIT staging and collaboration. UNIT TESTING - CODE COVERAGE: Junit, nUnit & Code Coverage with Sonar Qube, SonarQube - Code Quality Analysis.

UNIT-III

Build Automation - Continuous Integration (CI): Build Automation, What is CI, Why CI is Required, CI tools, Introduction to Jenkins (With Architecture), Jenkins workflow, Jenkins master slave architecture, Jenkins Pipelines, PIPELINE BASICS - Jenkins Master, Node, Agent, and Executor Freestyle Projects & Pipelines, Jenkins for Continuous Integration, Create and Manage Builds, User Management in Jenkins Schedule Builds, Launch Builds on Slave Nodes.

UNIT-IV

Continuous Delivery (CD): Importance of Continuous Delivery, Continuous Deployment Flow, Containerization with Docker: Introduction to Docker, Docker installation, Docker commands, Images & Containers, DockerFile, Running containers, Working with containers and publish to Docker Hub.

Testing Tools: Introduction to Selenium and its features, JavaScript testing.

UNIT-V

Configuration Management - ANSIBLE: Introduction to Ansible, Ansible tasks, Roles, Jinja templating, Vaults, Deployments using Ansible.

Containerization Using Kubernetes(OPENSHIFT): Introduction to Kubernetes Namespace & Resources, CI/CD - On OCP, BC, DC & ConfigMaps, Deploying Apps on Openshift Container Pods. Introduction to Puppet master and Chef.



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R24 BCA COURSE STRUCTURE AND SYLLABUS

(Applicable for batches admitted from 2024-2025)

Text Books:

1. Joyner, Joseph, DevOps for Beginners: DevOps Software Development Method Guide for Software Developers and It Professionals, 1st Edition Mihails Konoplow, 2015.
2. Alisson Machado de Menezes, Hands-on DevOps with Linux, 1st Edition, BPB Publications, India, 2021.

Reference Books:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10
2. Gene Kim Je Humble, Patrick Debois, John Willis. The DevOps Handbook, 1st Edition, IT Revolution Press, 2016.