JIIT NOIDA

Course Descriptions of B. Sc. in Computer Science program for 2022-2026 batch

First Semester

Introduction to Programming Using C (22B21MA111)

Introduction to Programming Using C will cover Introduction, Data types, Operators, and Control Flow, Array, Functions, Structures and Union, Pointers and File Handling.

Course Description

Course Code	**22B21MA111**	**Semester: Odd**	**Semester I Session 2022-23 Month from**	
Course Name	**Introduction to Programming Using C**			
Credits	**3**	**Contact Hours**	3-0-0	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K101.1	Explain various data types, memory allocation schemes, precedence of arithmetical and logical operations, and need of array, and structures	Understanding Level (C2)
K101.2	Draw the flow chart and write the high-level code for different problems	Understanding Level (C2)
K101.3	Apply and implement functions with or without pointers for different problems	Applying Level (C3)
K101.4	Demonstrate and implement various operations like traverse, insertion, deletion, etc. on files	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Introduction	Introduction to Logic building, Step by step solution to simple problems, developing logic/flow- chart/pseudo code to solve problems like simple/logical games, puzzles.	9
2.	Data types, Operators, and Control Flow	Data, variables and constants, data types, operators – binary, unary, ternary, operator precedence, operations using different operators, if, if-else, while, do-while, for, switch-case in C Programming	9
3.	Array	Fundamentals of Array, Implementation of 1D/2D Array and related operations like insertion, traversal, updation, etc. in C programming using	6

		different problems	
4.	Functions	Introduction to Functions and its implementation in C programming language, Functions using Pass by value, recursive functions	4
5.	Structures and Union	Introduction and implementation of Structures and Union in C programming, Array of Structures and related operations like insertion, traversal, updation, etc. in C programming using different problems, Function using structures	4
6.	Pointers	Pointers in C, Dynamic memory allocation for 1D/2D array and structures, Arithmetical operations on pointers, functions using pass by reference	6
7.	File Handling	Introduction to File, creation of files in C programming language, Modes of File Handling like read, write, update; different types of files like binary file and text file and respective operations like, opening, closing, reading, writing, end of file.	4
		Total Number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments)
Total	**100**

Project based learning: Each student in a group of 4-5 will apply the concepts of C programming to solve practical problems.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc)

Text Books

1	Herbert Schildt. "The Complete Reference C", 4th Edition, TMH, 2000
2	Ashok N. Kamthane, "Programming with ANSI and Turbo C", Pearson Education, Delhi, 2006
3	H. Cooper and H. Mullish, "Spirit of C", 4th Edition, Jaico Publishing House, 2006
4	Greg Perry, Dean Miller, "C Programming Absolute Beginner's Guide Paperback", QUE; 3 edition, 2013

Reference Books

1	Griffiths, David, and Dawn Griffiths, "Head First C: A Brain-Friendly Guide", O'Reilly Media, Inc., 2012.
2	Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Prentice-Hall India, New Delhi, 2002
3	B. A. Forouzan, R. F. Gilberg "Computer Science: A Structured Programming Approach Using C", 2nd Edition, Thomson Press, New Delhi, 2006

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K101.1	3	2	1	1	1		2	1	2	3	3	3
K101.2	3	2	2	3	1		3	1	2	3	3	3
K101.3	3	2	2	2	1		2	1	2	2	2	2
K101.4	3	2	2	2	1		3	1	2	3	3	3
Avg	3	2	2	2	1		3	1	2	3	3	3

Introduction to Programming Using C LAB (22B25MA111)

Introduction to Programming Using C Lab will cover Introduction, Data types, Operators, and Control Flow, Array, Functions, Structures and Union, Pointers and File Handling

Course Description

Course Code	**22B25MA111**	**Semester: Odd**	**Semester I Session 2022-23 Month from**
Course Name	**Introduction to Programming Using C LAB**		
Credits	**1**	**Contact Hours**	0-0-2
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K131.1	Develop programs/logic for data types, expressions and conditional structure.	Applying Level (C3)
K131.2	Perform programs for array and functions.	Applying Level (C3)
K131.3	Implement programs for structure and union.	Applying Level (C3)
K131.4	Perform programs of pointers and recursive functions.	Applying Level (C3)

K131.5	Implement menu driven programs to perform basic file operations.	Applying Level (C3)

Module No.	Subtitle of the Module	List of Experiments	No of Labs
1.	Introduction	Introduction to Logic building, Step by step solution to simple problems, developing logic/flow- chart/pseudocode to solve problems like simple/logical games, puzzles. Introduction to Code block (Editor for C)	2
2.	Data types, Operators, and Control Flow	Data, variables and constants, data types, operators – binary, unary, ternary, operator precedence, operations using different operators, if, if-else, while, do-while, for, switch-case in C Programming	2
3.	Array	Fundamentals of Array, Implementation of 1D/2D Array and related operations like insertion, traversal, updation, etc. in C programming using different problems	2
4.	Functions	Introduction to Functions and its implementation in C programming language, Functions using Pass by value, recursive functions	2
5.	Structures and Union	Introduction and implementation of Structures and Union in C programming, Array of Structures and related operations like insertion, traversal, updation, etc. in C programming using different problems, Structures using function	2
6.	Pointers	Pointers in C, Dynamic memory allocation for 1D/2D array and structures, Arithmetical operations on pointers, functions using pass by reference	2
7.	File Handling	Introduction to File, creation of files in C programming language, Modes of File Handling like read, write, update; different types of files like binary file and text file and respective operations like, opening, closing, reading, writing, end of file.	2
		Total No. of Labs	**14**

Evaluation Criteria

Components	Maximum Marks
Lab Test -1	20
Lab Test -2	20
Day to Day	60
(Evaluation 1- 15, Evaluation 2- 15, Mini Project- 15, Attendance- 15)	
Total	**100**

Project based learning: Each student in a group of 3-4 will develop a mini project with the help of various concepts of C programming. In a team they will learn how to apply the concepts for problem solving in a meaningful way.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc)

Text Books	
1	Herbert Schildt. "The Complete Reference C", 4th Edition, TMH, 2000
2	Ashok N. Kamthane, "Programming with ANSI and Turbo C", Pearson Education, Delhi, 2006
3	H. Cooper and H. Mullish, "Spirit of C", 4th Edition, Jaico Publishing House, 2006
4	Greg Perry, Dean Miller, "C Programming Absolute Beginner's Guide Paperback", QUE; 3 edition, 2013
Reference Books	
1	Griffiths, David, and Dawn Griffiths, "Head First C: A Brain-Friendly Guide", O'Reilly Media, Inc., 2012.
2	Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Prentice-Hall India, New Delhi, 2002
3	B. A. Forouzan, R. F. Gilberg "Computer Science: A Structured Programming Approach Using C", 2nd Edition, Thomson Press, New Delhi, 2006

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K131.1	3	2	1	1	1		2	1	2	3	3	3
K131.2	3	2	1	1	1		2	1	2	3	3	3
K131.3	3	2	2	2	1		2	1	2	3	3	3

K131.4	3	2	2	2	1		3	1	2	3	3	3
K131.5	3	2	3	2	1		3	1	2	3	3	3
Avg	3	2	2	2	1		3	1	2	3	3	3

Computer System Architecture (22B21MA112)

Computer system architecture will cover introduction, data representation and basic computer arithmetic, basic computer organization and design, central processing unit, memory organization and input output organization.

Course Description

Course Code	**22B21MA112**	**Semester: Odd**	**Semester I Session 2022-23 Month from**
Course Name	**Computer System Architecture**		
Credits	**4**	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K102.1	Summarize and compare the different computer systems based on RISC and CISC Architecture.	Analyzing Level (C4)
K102.2	Categorize different types of computers based on Instruction set Architecture.	Analyzing Level (C4)
K102.3	Apply the knowledge of performance metrics to find the performance of systems.	Applying Level (C3)
K102.4	Design RISC and CISC based Computer using Hardwired / Microprogrammed Controller.	Evaluating Level (C5)
K102.5	Create and analyze an assembly language program of RISC and CISC based systems.	Evaluating Level (C5)
K102.6	Apply the knowledge of pipeline, IO and cache to understand these systems. Further, analyze the performance of such systems.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	**Introduction**	Logic gates, Boolean algebra, combinational circuits, circuit simplification, flip-flops and sequential circuits, decoders, multiplexers, registers, counters and memory units.	04
2.	Data Representation and Basic Computer Arithmetic	Number systems, complements, fixed and floating-point representation, character representation, addition, subtraction, magnitude comparison,	06

		multiplication and division algorithms for integers	
3.	Basic Computer Organization and Design	Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt, Interconnection Structures, Bus Interconnection design of basic computer.	08
4.	Central Processing Unit	Register organization, arithmetic and logical micro-operations, stack organization, micro programmed control. Instruction formats, addressing modes, instruction codes, machine language, assembly language, input output programming, RISC, CISC architectures, pipelining and parallel architecture with examples.	07
5.	Memory Organization	Different Levels of Memory organization, Cache memory, Associative memory, mapping and its algorithm	10
6.	Input-Output Organization	Input / Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels.	07
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance 10, Quiz 10, Tutorial 5 Marks)
Total	**100**

Project based learning: Project is an integral part of the Subject. Student form group size 3-4, and discuss the project idea with their faculty before finalizing. All projects are based on hardware and hardware components. Programming language is used as per processor/controller. Students develop projects/prototypes to interact with physical environment, control physical object with software. Students learn various processor architecture as well as their programming languages.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	M. Morris Mano, Computer System Architecture, Prentice Hall of India Pvt Ltd, Fourth Edition, 2008.
2.	William Stallings, Computer Organization and Architecture–Designing for Performance, Ninth Edition, Pearson Education, 2013.

3.	John L. Hennessy and David A Patterson, Computer Architecture A Quantitative Approach, Morgan Kaufmann / Elsevier, Sixth Edition, 2019
4.	Carl Hamacher, Computer Organization, Fifth edition, McGraw-Hill, 2012.
5.	M.M. Mano, Digital Design, Pearson Education Asia,2018
6.	Nicholas Carter, Schaum's outline of Computer Architecture, Tata McGraw Hill, Special Edition, 2006.
7.	Ramesh Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, Prentice Hall, Sixth Edition, 2013.
8.	Barry B. Brey, The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, and Core2 with 64-bit Extensions: Architecture, Programming, and Interfacing. Pearson Education India, Eighth Edition, 2009.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K102.1	3	3	2	2	1	2	2	1	2	3	2	3
K102.2	3	2	2	2	1	2	2	1	2	3	2	3
K102.3	3	3	2	1		1	3	1	3	3	3	3
K102.4	3	3	2	3	1	2	3	1	2	3	3	3
K102.5	3	2	3	1			2	1	1	3	3	3
K102.6	3	3	3	2		1	1	1	1	3	2	3
Avg	3	3	2	2	1	2	3	3	3	3	3	3

Discrete Mathematical Structures (22B21MA113)

Set theory, basic operations on sets, Venn diagram, relations, Hasse diagram, lattices, boolean algebra, numeric functions, generating functions, recursive functions, solution of recurrence relations of constant coefficients, predicate and propositional calculus, graphs, subgraphs, isomorphism of graphs, Eulerian and Hamiltonian graph, graph coloring, minimum spanning tree, digraphs, adjacency matrix, incidence matrix, path matrix, groups, rings, fields.

Course Description

Course Code	**22B21MA113**	**Semester Odd**	**Semester I Session 2022-23 Month from**
Course Name	**Discrete Mathematical Structures**		
Credits	4	**Contact Hours**	3-1-0
	Coordinator(s)		

Faculty (Names)	Teacher(s) (Alphabetically)	

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		COGNITIVE LEVELS
K121.1	explain partial order relations and Hasse diagram	Understanding Level (C2)
K121.2	explain lattices and Boolean algebra and solve the problem of recurrence relations of constant coefficients.	Applying Level (C3)
K121.3	explain the propositional and predicate calculus to check the validity of arguments.	Understanding Level (C2)
K121.4	demonstrate graphs, digraphs, trees and use it to solve the different problems of graph theory.	Applying Level (C3)
K121.5	illustrate various algebraic structures and their properties.	Understanding Level (C2)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Set theory and Relations	Basic concept of set theory, operations on sets, Venn diagram, relations and their composition, pictorial representation, matrix and graphical representations, equivalence relations and partitions, closure of relation, Warshall's algorithm for transitive closure, partial ordered relations and POSET, Hasse diagram, Isomorphism of partial order relation	10
2.	Lattices, Boolean Algebra and Numeric Functions	Different types of lattices, isomorphic lattices, Boolean algebra, discrete numeric functions, asymptotic behavior of numeric functions, generating functions, solution of recurrence relations by generating function, recursive functions, homogenous and particular solution of recurrence relations of constant coefficients.	12
3.	Predicate and Propositional Calculus	Propositions- simple and compound, basic logical operators and their truth tables, tautologies and contradictions, validity of arguments. Normal forms: disjunctive and conjunctive normal forms, Predicates and quantifiers, logical equivalence.	7
4.	Graphs	Graphs and related definitions, subgraphs, isomorphism, paths and connectivity, Eulerian graph and Konigsberg problem, Hamiltonian graph, minimum spanning tree (Prim's algorithm), graph colorings, digraphs, adjacency matrix, incidence matrix, path matrix	9
5.	Algebraic Structures	Groups- definitions and examples, order of elements, subgroup, cyclic group, rings and fields.	4
Total number of Lectures			**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials)

Total	**100**
Project based learning: A group of 4 to 5 students will be formed. Each group will have a group leader to develop coordination among the group members. Each group will be assigned a problem related to the diversified applications of graph theory and theory of automata. The group leader of each group will submit a report of 6-7 pages and then finally each member of the group will be evaluated through a viva voce.	
Recommended Reading material:	
1.	Lipschutz, S., Lipson, M.L, and Patil, V.H., Discrete Mathematics, Revised 3rd Edition, McGraw-Hill Education, 2017.
2.	Rosen, K. H., Discrete Mathematics and its Application, 7th Edition, Tata McGraw-Hill, 2011.
3.	Liu, C. L., Mahapatra, D., Elements of Discrete Mathematics: A Computer Oriented Approach, 4th Edition, McGraw-Hill, 2017.
4.	Kolman, B., Busby, R. C. and Ross, S., Discrete Mathematical Structures, 6th Edition, Pearson Education India, 2015.
5.	Deo, N., Graph Theory, Prentice Hall of India, 1980.
6.	Grimaldi, R.P., Discrete and Combinatorial Mathematics, 4th Edition, Pearson Education, 2005.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K121.1	2	2	2	1	1		1	2	2	1	1	1
K121.2	2	2	2	1	1		1	1	2	2	1	2
K121.3	1	2	1	1	1		1	1	1	1	1	1
K121.4	3	2	2	2	1		2	1	2	2	2	2
K121.5	2	1	2	2	1		2	1	2	2	2	2
Avg	2	2	2	2	1		2	2	2	2	2	2

Physics-1 (15B11PH111)

Course Description

Course Code	**15B11PH111**	**Semester: Odd**	**Semester: 1 Session: 2022-2023 Month from:**
Course Name	**Physics-1**		
Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		
COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:			**COGNITIVE LEVELS**

C101.1	Recall the basic principles of physics related to optics, relativity, quantum mechanics, atomic physics.	Remembering Level(C1)
C101.2	Illustrate the various physical phenomena with interpretation based on the mathematical expressions involved.	Understanding Level (C2)
C101.3	Apply the concepts/principles to solve the problems related to wave nature of light, relativity, quantum mechanics and atomic physics.	Applying Level (C3)
C101.4	Analyze and examine the solution of the problems using physical and mathematical concepts involved.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Physical Optics	Analytical treatment of interference, Intensity distribution of fringe system, Fresnel's Bi-prism, Newton's rings, Michelson interferometer, Diffraction(limited to Fraunhofer class) from Single slit, double slit and Diffraction grating, Polarization, Phenomenological understanding of Birefringence, Principles of use of uni-axial crystals in practical polarizers, compensators and wave plates, Production and analysis of completely polarized light. Retardation Plate, Optical activity, Polarimeter. Resolving Power of Microscope.	17
2.	Relativity	Frame of references, Galilean Transformations, Michelson-Morley experiment, Lorentz transformations, Addition of velocities, Mass variation with velocity, Mass-energy relation.	5
3.	Atomic Structure	Origin of spectral lines, spin and orbital angular momentum, Quantum numbers, Designation of States, Atoms in magnetic field, Zeeman effect.	5
4.	Radiation	Black body radiation, Wein's law, Rayleigh Jeans law, Implications of Bose-Einstein statistics,Planck's law of radiation, Wein's Displacement Law.	5
5.	Quantum Mechanics	Wave-particle duality, Compton scattering, Matter waves, Heisenberg's uncertainty principle, Schrödinger wave equation and its applications to the free particle in a box (1D+3D), potential barrier and tunnel diode as its application	10
		Total number of Lectures	**42**

Project Based Learning (PBL): The students will be given small projects (in groups) on various topics like Interference, diffraction, polarization, relativity, radiations, Quantum mechanics, to explore their applications in engineering, and technology to understand the role of physics. This will help the students to connect the concept studied in the class with their application in engineering and technology and will enhance their analytical skills.

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 [Attendance, Class Test, Quizzes, Assignments, PBL]
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Ajoy K. Ghatak, Optics, Edition 5, Tata McGraw-Hill Publishing Company Limited 2015.
2.	E. Hecht, *Optics*, Edition 5, Pearson Education 2017
3.	F. A. Jenkins and H. E. White, *Fundamentals of optics*, Edition 3, Tata McGraw Hill 1955
4.	R. S. Sirohi, *Wave Optics and Its Applications*, Orient and Longman 1993
5.	Robert Resnick, *Introduction to Special Relativity*, Wiley1968

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
C101.1					1	1			2			
C101.2			2						2			
C101.3			2		1				2			
C101.4			2						2			
Avg			2		1	1			2			

ENGLISH (22B28HS111)

English as a Communication Tool: Basic aspects of English: LSRW: Listening, Speaking, Reading, Writing. Non-Verbal Communication, Presentation Techniques, Gambits, Phonetics, Grammar, Vocabulary Enrichment techniques, Error Analysis. Literary & Rhetorical Devices, Textual Organization: Letter Writing, Email Etiquettes, Feedbacks and Review Writing· Notice, Agenda and Minutes· Format of Report Writing· CV and Resume.

Course Description

Course Code	**22B28HS111**	**Semester: Odd**	**Semester I Session 2022-23 Month from**
Course Name	**English**		
Credits	**2**	**Contact Hours**	1-0-2
Faculty (Names)	**Coordinator(s)**		

	Teacher(s) (Alphabetically)		
COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:			**COGNITIVE LEVELS**
K151.1	Develop an understanding and appreciate the basic aspects of English as a communication tool.		Understanding Level (C2)
K151.2	Apply grammar concepts and vocabulary skills in presentation and in spoken and written communication.		Applying Level (C3)
K151.3	Identify and explain different literary and rhetorical devices used in discourse.		Analyzing Level (C4)
K151.4	Compose different forms of professional writing.		Creating Level (C6)
K151.5	Apply Phonetics through theory and practice for better pronunciation.		Applying Level (C3)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	English as a Communication Tool	Communication, Basic aspects of English: LSRW: Listening/ Speaking, Reading/ Writing, Non-Verbal Communication, Presentation Techniques and Gambits for Interviews	6
2.	Language and Literary devices	Phonetics: Pronunciation, Stress, Rhythm, Intonation, Literary and Rhetorical Devices	2
3.	Professional Application/Writing	Letter Writing, Email Etiquettes, Review Writing, Notice, Agenda and Minutes, Format of Report Writing, CV and Resume	3
4.	Grammar & Vocabulary	Parts of Speech and Agreement of Noun-Verb, Tense, Aspect, Mood and Voice, Vocabulary Enrichment techniques, Synonyms, Antonyms, Homonyms, Homophones, Collocation	3
		Total number of Lectures	**14**

English LAB			
S.No.	**Title of the Module**	**List of Experiments**	**No. of Labs**

1	Interpersonal Oral Communication through self-Introduction	Interpersonal Communication; Learning the Impact of Perception on Interpersonal Communication	2
2	Confident Non- Verbal Behaviour	To be able to impart good body language and learn aspects of non-verbal behaviour	2
3	Basics of Formal Presentations	PPT Presentation; Reading Newspapers, comprehending and presenting in own words with confidence & assertiveness	2
4	Listening through Language Lab Software (SKY IELTS)	Active Listening; Academic Listening; Listening to Debates and Presentations; Note-taking Techniques; comprehending through lab software	2
5	Phonetics and Pronunciation through lab (SKY Pronounce)	Phonetics; Speaking	2
6	Reading Practice & Comprehension through SKY Read Up Speed Up Software	Purpose, Process, Methodologies; Skimming and Scanning; Levels of Reading; Reading Comprehension; Academic Reading Tips	2
7	Grammar for Professional Writing Requirements: Parts of Speech; Tense, Voice, Types of Sentences; Vocabulary Enhancement	Passage Comprehension; Jumbled Paragraphs for grammar learning; Summary/Inference of short paragraph; Picking the Out of Context sentence in a Jumbled Paragraph; Email Writing etiquettes; Nature and Style of sensible Writing: Describing, Defining, Classifying, providing examples or evidence,Writing introduction and conclusion	2
		Total No. of Labs	**14**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	30 (Lab Exam)
End Semester Examination	40

TA	30 (Quiz, Assignments, Tutorials)
Total	**100**

PBL Component: The creative writing project is to be done in a group of 3-4 students. Students will be asked to choose one specific word that impacts all six dimensions of their life-mental, physical, emotional, relational, spiritual and financial and create a project based on that.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**C.L.Bovee, J.V.Thill, M.Chaturvedi**, *Business Communication Today*,9th Ed, Pearson Education, copyright@ Dorling Kinderslay (India) Pvt Ltd,2009
2.	**Kelly M. Quintanilla and S.T.Wahl**, *Business and Professional Communication*, Sage Publications Pvt India Ltd,2011
3.	**S. Kumar and Pushp Lata,** *Communication Skills*, Oxford University Press,1st, Ed. 2011
4.	**R.K Bansal, and J.B Harrison**, *Spoken English for India*, Orient Longman, 2018
5.	**M A Yadugiri,** The Pronunciation of English: Principles and Practice, Viva Books Pvt. Ltd, India, 2015
6.	**A. R. Rizvi,** Effective Technical Communication, 2nd edition, McGraw Hill Education Private Limited, Chennai, 2018.
7.	**Raymond Murphy,** English Grammar in Use, 4th edition, Cambridge University Press, 2012.
8.	**Hewings, M**. *English Pronunciation in Use*. Advanced. Cambridge: CUP, 2009
9.	**Krishna Mohan and N. P. Singh**, *Speaking English Effectively* 2nd Edition. Macmillan Publishers India Ltd. Delhi. 2011
10.	**Suresh Kumar, E. & Sreehari, P**. *A Handbook for English Language Laboratories*. New Delhi: Foundation, 2009.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K151.1								3	2			
K151.2							1	3	2			
K151.3								3	2			
K151.4							1	3	2			
K151.5								3				

Avg							1	3	2			

Life Skills and Effective Communication (22B12HS111)

Overview of Life Skills, Life Skills for Self, Family, Society and lifelong success. Advanced Reading and Comprehension Skills, inferring lexical and contextual meaning, employing discourse analysis, Advanced Speaking Skills, Advanced Writing skills. Team- work skills, Empathy, Emotional Intelligence, VUCA Leadership, Resilience, Tolerance, Self-Belief and Time Management. Presentation and Interaction Skills: Speech Delivery, Group Discussion, Presentation Skills, Public Speaking, Audience Analysis, Interviews, Assessment of Personality. Creativity: Definition; Characteristics of Creative Person: Fluency; Originality; Curiosity; Critical Thinking, Problem Solving Techniques. Harmony in personal and social life, Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all. Understanding Nine universal values in relationships. Character, Righteousness and Virtues for A Meaningful Life: Self-Realization Through Spiritual texts.

Course Description

Subject Code	**22B12HS111**	**Semester: Odd**	**Semester: I Session: 2022-2023 Month from**
Subject Name	**LIFE SKILLS AND EFFECTIVE COMMUNICATION**		
Credits	**2**	**Contact Hours**	1-0-2
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K161.1	Understand different life skills required for Self, Family, Society and lifelong success.	Understanding Level (C2)
K161.2	Apply listening, speaking, reading and writing skills in professional environment.	Applying Level (C3)
K161.3	Develop Work-place skills for personal and professional excellence.	Analyzing Level (C4)
K161.4	Evaluate and make decisions for empowerment of self and others.	Evaluating Level (C5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No of Lectures**
1.	Introduction	Overview of Life Skills: Meaning and significance of life skills, Life skills identified by various organizations, Life Skills for Self, Family, Society and lifelong success.	2
2.	Advanced LSRW Skills	Advanced Reading and Comprehension Skills, inferring lexical and contextual meaning, employing discourse analysis, Advanced Speaking Skills: Conversations, Dialogues and Debates, Persuasion, Negotiation Skills, Expressing Opinions, Agreement and Disagreement, Advanced Listening Skills,	2

		Advanced Writing skills: The art of Condensation, Note making, Essay Writing.	
3.	Work-Place Skills	Interpersonal Skills: Team- work skills, Empathy, Emotional Intelligence, VUCA Leadership, Resilience, Tolerance, Self-Belief and Time Management	3
		Presentation and Interaction Skills: Speech Delivery, Group Discussion, Presentation Skills (Focused and targeted information seeking and presentation), Public Speaking, Audience Analysis, Interviews, Assessment of Personality - Projective& Self Report Techniques - Building Self-Confidence – Enhancing Personality Skills.	2
		Creativity and Critical Thinking: Creativity: Definition; Characteristics of Creative Person: Fluency; Originality; Curiosity; Critical Thinking, Problem Solving Techniques: Six Thinking Hats, Mind Mapping etc.	2
4.	Ethics and Holistic Life	Harmony in personal and social life: Professional Integrity, Respect & Equality, Building Trusting Relationships. Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all. Understanding Nine universal values in relationships. Understanding harmony in the Family. Harmony in the Family; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship. Understanding the harmony in the society (society being an extension of family): Undivided Society (AkhandSamaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family. Gender Harmony & equity.	2
		Character, Righteousness and Virtues for A Meaningful Life: Self-Realization Through Spiritual texts: Egoless, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri / Comradeship, Cooperation, Tolerance and Gratitude.	1
		Total number of Lectures	**14**

LIFE SKILLS AND EFFECTIVE COMMUNICATION LAB			
Experiment No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction	Tell Me About Yourself & Elevator Pitch	K161.1
2.		Personal Effectiveness and Who Am I activity	K161.1
3.	Advanced LSRW Skills	Academic Listening	K161.2
4.		Reading	K161.2
5.		Essay Writing	K161.2
6.	Work-Place Skills	Group Discussions-1	K161.3
7.		Group Discussions-2	K161.3
8.		Technical Presentations-1	K161.3
9.		Technical Presentations-2	K161.3

10.		Critical Thinking and Creativity	K161.3
11.		Handling Interviews	K161.3
12.	Ethics and Holistic Life	TED Talk analysis of Social, Health and Cultural analysis	K161.4
13.		TED Talk analysis of Social, Health and Cultural analysis	K161.4
14.		Self-Realization Through Spiritual texts	K161.4

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	30 (Lab Exam)
End Semester Examination	40
TA	30 (Quiz, Assignments, Tutorials)
Total	**100**

Project Based Learning:

Students, in groups of 4-5, are required to visit Old Age Home/ Underprivileged Children/ NGO/ Cancer Hospital / etc. Spend time with them for 3-4 hours. Apply Life Skills learned in understanding their feeling and help them by providing solution to ease their stress. Document your visit and present in the class.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Book(s):

1.	Wadkar Alka, Life Skills for Success, Sage Publication Pvt Ltd, 2019
2.	Human Values, A.N. Tripathi, New Age International Pvt Ltd. Publishers New Delhi ,2005

Reference Book(s):

3.	Carnegie Dale, Become an Effective Leader, New Delhi: Amaryllis, 2012
4.	Harold R. Wallace et. al, Personality Development, Cengage Learning India Pvt. Ltd; New Delhi, 2006
5.	Barun K. Mitra, Personality Development & Soft Skills, Oxford University Press, New Delhi, 2012.
6.	Mark G. Frank, David Matsumoto, Hyi Sung Hwang, Nonverbal Communication: Science and Applications, 2012, 1st Edition, Sage Publications, New York.
7.	William S. Pfeiffer, Public Speaking, Pearson, Delhi, 2012.
8.	Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
9.	S. Kumar and Pushp Lata, Communication Skills, Oxford University Press,1st, Ed. 2011
10.	Raman M. and S. Sharma, Technical Communication: Principles & Practices, 29th Impression, Oxford University Press, New Delhi, 2009

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K161.1					3		1		3			
K161.2								3	3			
K161.3							3	3	3			

K161.4					3		2		3			
Avg					3		2	3	3			

Multimedia and Animation Workshop (22B28MA111)

Microsoft Word, Microsoft Excel, Microsoft Power Point, Introduction to Image tools, Basic Photo Corrections, Working with Selections, Layer Basics, Masks and Channels, Typographic Design and Video tools.

Course Description

Course Code	**22B28MA111**	**Semester: Odd**	**Semester I Session 2022-23 Month from**
Course Name	**Multimedia and Animation Workshop**		
Credits	**2**	**Contact Hours**	1-0-2
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above-mentioned course, the students will be able to:		
K171.1	Explain the concepts of Microsoft office tools such as word, PowerPoint and excel	Understanding Level (C2)
K171.2	Demonstrate basic text editing, text formatting. page formatting, methods and reasons for using templates,	Applying Level (C3)
K171.3	Demonstrate basic Excel spreadsheet operations, data entry, and functions and basic Microsoft PowerPoint operations	Applying Level (C3)
K171.4	Explain the concept of image tools and functions	Understanding Level (C2)
K171.5	Demonstrate working with photo correction, Straightening and cropping	Applying Level (C3)
K171.6	Demonstrate working with selections, layers, masks and channel.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Microsoft Word	Microsoft Word: Creating, editing, saving and printing text documents, Font and paragraph formatting, Simple character formatting, Inserting tables, smart art, page breaks, Using lists and styles, Working with images, Using Spelling and Grammar check, Understanding document properties, Mail Merge	1
2.	Microsoft Excel	Spreadsheet basics, Creating, editing, saving and printing spreadsheets, working with functions &	2

		formulas, modifying worksheets with color & auto formats, graphically representing data: Charts & Graphs, speeding data entry: Using Data Forms, analyzing data: Data Menu, Subtotal, Filtering Data, formatting worksheets, Securing & Protecting spreadsheets	
3.	Microsoft Power Point	Opening, viewing, creating, and printing slides, applying auto layouts, adding custom animation, using slide transitions, graphically representing data: Charts & Graphs, Creating Professional Slide for Presentation	1
4.	Introduction to Image tools	Raster vs. Vector, creating new images, saving files for print, saving files for web/screen, Working with Adobe Bridge, Using the tools, Using the options bar and other panels, Undoing actions in Photoshop, Customizing the workspace, Tools panel overview	2
5.	Basic Photo Corrections	Strategy for retouching, Resolution and image size, Adjusting the color in Camera Raw, Straightening and cropping the image in Photoshop, replacing colors in an image, adjusting saturation with the Sponge tool, repairing areas with the Clone Stamp tool, Using the Spot Healing Brush tool, using content-aware fill, Applying the Unsharp Mask filter	2
6.	Working with Selections	About selecting and selection tools, Using the Quick Selection tool, moving a selected area, manipulating selections, Using the Magic Wand tool, selecting with the lasso tools, rotating a selection, selecting with the Magnetic Lasso tool, cropping an image and erasing within a selection, Refining the edge of a selection,	2
7.	Layer Basics, Masks and Channels	About layers, Using the Layers panel, rearranging layers, applying a gradient to a layer, applying a layer style, Flattening and saving files, working with masks and channels, creating a mask, refining a mask, creating a quick mask, manipulating an image with Puppet Warp, Working with channels	2
8.	Typographic Design and Video tools	About type, creating a clipping mask from type, creating type on a path, Warping point type, Designing paragraphs of type. Video tools: Open Shot; Shortcut; Blender; Movie Maker 10; iMovie; Kapwing; KineMaster, Lightworks etc.	2
		Total Number of Lectures	**14**

Multimedia and Animation Workshop LAB			
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Microsoft Word	Microsoft Word: Creating, editing, saving and printing text documents, Font and paragraph	1

		formatting, Simple character formatting, Inserting tables, smart art, page breaks, Using lists and styles, Working with images, Using Spelling and Grammar check, Understanding document properties, Mail Merge	
2.	Microsoft Excel	Spreadsheet basics, Creating, editing, saving and printing spreadsheets, Working with functions & formulas, Modifying worksheets with color & auto formats, Graphically representing data : Charts & Graphs, Speeding data entry : Using Data Forms, Analyzing data : Data Menu, Subtotal, Filtering Data, Formatting worksheets, Securing & Protecting spreadsheets	2
3.	Microsoft Power Point	Opening, viewing, creating, and printing slides, Applying auto layouts, Adding custom animation, Using slide transitions, Graphically representing data : Charts & Graphs, Creating Professional Slide for Presentation	1
4.	Introduction to Image tools	Raster vs. Vector, Creating new images, Saving files for print, Saving files for web/screen, Working with Adobe Bridge, Using the tools, Using the options bar and other panels, Undoing actions in Photoshop, Customizing the workspace, Tools panel overview	2
5.	Basic Photo Corrections	Strategy for retouching, Resolution and image size, Adjusting the color in Camera Raw, Straightening and cropping the image in Photoshop, Replacing colors in an image, Adjusting saturation with the Sponge tool, Repairing areas with the Clone Stamp tool ,Using the Spot Healing Brush tool, Using content-aware fill, Applying the Unsharp Mask filter	2
6.	Working with Selections	About selecting and selection tools, Using the Quick Selection tool, Moving a selected area , Manipulating selections ,Using the Magic Wand tool, Selecting with the lasso tools, Rotating a selection, Selecting with the Magnetic Lasso tool , Cropping an image and erasing within a selection ,Refining the edge of a selection,	2
7.	Layer Basics, Masks and Channels	About layers, Using the Layers panel, Rearranging layers, Applying a gradient to a layer, Applying a layer style, Flattening and saving files, Working with masks and channels, Creating a mask, Refining a mask, Creating a quick mask, Manipulating an image with Puppet Warp, Working with channels	2
8.	Typographic Design and Video tools	About type, Creating a clipping mask from type, Creating type on a path, Warping point type, Designing paragraphs of type. Video tools: OpenShot; Shotcut; Blender; Movie Maker 10; iMovie; Kapwing; KineMaster, Lightworks etc	2
		Total number of Labs	**14**
Evaluation Criteria Components		**Maximum Marks**	

Mid Term	30 (Lab Exam)
End Semester Examination	40
TA	30 (Quiz, Assignments, Tutorials)
Total	**100**

Project based learning: Each student in a group of 4-5 will apply the concepts of multimedia and utilize multimedia tools to perform various operations on the multimedia application.

Recommended Reading material:

1.	Lambert, Joan, and Curtis Frye. Microsoft Office 2019 Step by Step. Microsoft Press, 2018.
2.	Foulkes, Linda. Learn Microsoft Office 2019. 1st ed. Packt Publishing, 2020. Web. 25 Sept. 2021.
3.	David W Beskeen, Carol M Cram, Lynn Wermers, Jennifer Duffy, Lisa Friedrichsen, Illustrated Microsoft Office 365 & Office 2019, 2019.
4.	Prabat K Andleigh and Kiran Thakrar, ―Multimedia Systems and Design, PHI, 2003.
5.	Donald Hearn and M.Pauline Baker, ―Computer Graphics C Version, Pearson Education, 2003.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K171.1	3			2			1	1	3	2	2	2
K171.2	3	1	1	2			1	1	3	2	2	2
K171.3	3	1	1	2				1	3	2	2	2
K171.4	3	1	1	3	2		1	1	3	3	3	3
K171.5	3	1	1	3	2		1	1	3	3	3	3
K171.6	3	1	1	3	2		1	1	3	3	3	3
Avg	3	1	1	3	2		1	1	3	3	3	3

Second Semester

Object Oriented Programming using C++ (23B51CS121)

Principles of Objective Oriented Programming, Token Expressions & Control Structures, Functions in C++, Classes & Objects, Constructors & Destructors, Operator Overloading,

Inheritance, Pointers, Virtual Functions & Polymorphism, Exception handling, Working with Files

Course Description

Course Code	23B51CS121	**Semester: Even**	**Semester: II Session 2022-2023** Month from: Jan-June 2023
Course Name	Object Oriented Programming using C++		
Credits	**3**	**Contact Hours**	**3-0-0**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES After pursuing the course, the students will be able to		**COGNITIVE LEVELS**
K111.1	explain the fundamental principles of object-oriented programming.	Understand Level (Level 2)
K111.2	analyze the output of the source code and able to debug the errors.	Analyze Level (Level 4)
K111.3	construct the class diagram for real life problems and implement it using virtual functions, abstract classes.	Apply Level (Level 3)
K111.4	make use of exception handling in C++.	Apply Level (Level 3)
K111.5	demonstrate and apply various operations like traverse, insertion, deletion, etc. on files.	Apply Level (Level 3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Principles of Objective Oriented Programming	Object Oriented Programming Paradigm, Basic Concepts of Object-Oriented Programming, Benefits of Object-Oriented Programming, Object Oriented Languages, Applications of Object-Oriented Programming, Beginning with C++.	**5**
2.	Token Expressions & Control Structures	Tokens, Keywords, Identifiers and Constants, Data Types, Type Compatibility, Variables, Operators in C++, Implicit Conversions, Operator Overloading, Operator Precedence, Control Structures.	**5**
3.	Classes & Objects,	Objects, Classes, Internal representations of Objects, The Main Function, Function Prototyping, Call by Reference, Return by Reference, Inline	**12**

	Functions in C++	Functions, Function Overloading, Friend and Virtual Functions. Specifying a class, Member Functions, Arrays within a class, Static Member Functions, Arrays of Objects, Friendly Functions.	
4.	Constructors & Destructors, Operator Overloading, Inheritance	Constructors, Parameterized Constructors, Copy Constructors, Dynamic Constructors, Destructors, Defining Operator Overloading, Overloading Operators, Rules for Overloading Operators, Type Conversions.	**8**
5.	Pointers, Virtual Functions & Polymorphism,	Pointers, Pointers to Objects, this pointer, Pointer to Derived Classes, Virtual Functions	**7**
6.	Exception handling, Working with Files	Exceptions, Try, Catch and Throw, Re-throwing exceptions, Classes for File Stream Operations, Opening and Closing a File, File Modes, File Pointers, Input Output Operations, Updating a File.	**5**
		Total Number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments)
Total	**100**

Project based learning: Each student in a group of 3-4 will have to develop a mini project based on object-oriented programming concepts. The students have to design the class diagram for any real-world application. The students have to implement the mini project using C++language. Project development and its presentation will enhance the knowledge and employability of the students in IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc)

Text Books

1	**Schildt H.**, C++: The Complete Reference, McGraw-Hill Osborne Media, 4th Edition, 2017

2	**Lafore R.,** Object-Oriented Programming in C++. Sams Publishing, 4th Edition, 2001.
3	**Balagurusamy E.**, Object-oriented programming with C++, TMH, 8th Edition, 2021.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K111.1	2	2	2	2	1		2	1	1	3	3	3
K111.2	3	3	3	2			1	1	2	3	3	3
K111.3	3	3	3	2	1	1	2	2	2	3	3	3
K111.4	3	3	3	2			1	1	2	3	3	3
K111.5	3	3	3	2			1		1	3	3	3
Avg	3	3	3	2	1	1	2		2	3	3	3

Object Oriented Programming using C++ - LAB (23B51CS521)

Control structures in C++, Object oriented concepts like class, objects, constructors, destructors, function and operator overloading, etc. using C++, Inheritance Private/Public inheritance, Multiple Inheritance using C++, Polymorphism using C++, Exceptions in C++, File handling in C++.

Course Description

Course Code	**23B51CS521**	**Semester: Even**	**Semester: II Session: 2022-23** **Month from: Jan - June 2023**
Course Name	Object Oriented Programming using C++ - LAB		
Credits	**1**	**Contact Hours**	**0-0-2**

Faculty (Names)	**Coordinator(s)**	
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES After pursuing the course, the students will be able to		**COGNITIVE LEVELS**
K136.1	develop programs in C++ to implement control structures.	Apply Level (Level 3)
K136.2	develop programs in C++ to implement OOPs concepts related to objects, classes, constructor, destructor, and friend function.	Apply Level (Level 3)
K136.3	develop programs in C++ using OOPs concept like encapsulation, inheritance, polymorphism and abstraction.	Apply Level (Level 3)
K136.4	make use of exception handling in C++ programs.	Apply Level (Level 3)
K136.5	develop program in C++ for file handling.	Apply Level (Level 3)

Module No.	**Title of the Module**	**List of Experiments**	**No. of Labs for the module**
1.	Control structures in C++	Develop C++ programs using conditional structure (if, if-else, nested if), and iterative control structure (do-while, while, for). Implement switch case statement.	2
2.	Object oriented concepts using C++	Write output-based C++ programs to implement the concepts of Objects, Classes, encapsulation, Constructors, Destructors, Function and Operator Overloading, Static and Friend Functions.	3
3.	Inheritance using C++	Write programs in C++ to implement concepts of Base Class, Derived class, Method Overriding, Private and Public Inheritance, Multiple Inheritance.	2
4.	Polymorphism using C++	Write programs in C++ using Virtual Functions, Pure Virtual Functions, Abstract Classes, operator overriding.	2
5.	Exceptions in C++	Write programs in C++ using Exceptions, Try, Catch and Throw, Re-throwing exceptions, Exception and Inheritance,	2
6.	File handling in C++	File creation, Modes of File handling like read, write, update	1
		Total number of Labs	**12**

Evaluation Criteria

Components	**Maximum Marks**
Lab Test -1	20
Lab Test -2	20
Day to Day	60

(Evaluation 1- 15, Evaluation 2- 15, Mini Project- 15, Attendance- 15)

Total	100
Project based leaning: Groups of 3-4 students will choose a project topic. They will use the concepts of OOP and/or database to execute their project. In a team, they will learn how to apply the concepts for problem solving in a meaningful way.	

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1	**Schildt H.,** C++: The Complete Reference, McGraw-Hill Osborne Media, 4th Edition, 2017
2	**Elmasri R., Navathe S.B.,** Fundamentals of Database Systems, Pearson, 7th Edition, 2016
3	**Stroustrup B.**, The C++ Programming Language, Addison Wesley, 4th Edition, 2013
4	**Silberschatz A., Korth H. F., Sudarshan S.**, Database System Concepts, 6th Edition, McGraw-Hill, 2010.
5	**Lafore R.,** Object-Oriented Programming in C++. Sams Publishing, 4th Edition, 2001.
6	**Hubbard J.R.,** Schaum's Outline of Programming with C++, McGraw-Hill, 2nd Edition, 2000

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K136.1	3	3	2	2			1		1	3	3	3
K136.2	3	3	3	2	1	1	2		2	3	3	3
K136.3	3	3	3	3	1	1	2		2	3	3	3
K136.4	3	3	3	2			1		2	3	3	3
K136.5	3	3	3	2			1		2	3	3	3
Avg	3	3	3	3	1	1	2		2	3	3	3

Data Structures (23B21MA111)

Introduction to Algorithm and Data Structures, operations on Data Structures, Linear Data Structures, Linked Lists, Stacks, Queues, Nonlinear Data Structures, Tree, Binary Search Tree, Heaps, Sorting and Searching, Tree traversal, Hashing and its applications.

Course Description

Course Code	23B21MA111	**Semester** Even	**Semester II Session - 2022-23** **Month from** Jan - June 2023
Course Name	Data Structures		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES After pursuing this course, the students will be able to		**COGNITIVE LEVELS**
K112.1	demonstrate familiarity with major data structures.	Understanding Level (C2)
K112.2	explain and construct linear data structure.	Applying Level (C3)
K112.3	apply the concepts of tree-based data structures and hashing in various practical problems.	Applying Level (C3)
K112.4	apply data-structures algorithm in sorting of data, text compression and cryptography.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Algorithm and Data Structures	**Algorithms:** Definition, Properties, Performance Analysis-Space Complexity, Time Complexity, Asymptotic Notations. **Data structures:** Introduction, classification of Data Structures, Operations on data structures.	4
2.	Linked Lists	Traverse, Insert, Delete, operations on Singly linked lists, Circular linked lists, Doubly linked lists, Selection sort, Bubble sort, Insertion sort, Linear search, Binary search.	7

3.	Stacks	Implementation of stacks using Arrays and linked list, PUSH, POP operations, Evaluation of Infix, Postfix and Prefix Expressions.	5
4.	Queues	Implementation of Queues using Arrays and linked list, Insertion and deletion operations on Circular queues and Priority queues	5
5.	Trees	Array and Linked list Representation of Binary Trees, Properties of Binary Tree, Traversing a Binary Tree, Merge sort, Quick sort.	5
6.	Binary Search Trees	Traverse, search, Insert and Delete operations in Binary Search Tree, importance of balancing.	5
7.	Heaps	Heap Property, Max Heap, Min Heap, Heap Sort.	3
8.	Hashing	One way hashing functions and their properties, hashing as a search structure, hash table, uses of hash tables in text compression and cryptography.	6
9.	Graphs	Definition, terminology, directed and undirected graphs, properties, connectivity in graphs, applications, implementation – adjacency matrix.	2
Total number of lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments)
Total	**100**

Project based learning: Students in small groups will be assigned the problem of searching and soring of data; design algorithms for information retrieval from tree or graph. They will prepare corresponding computer programs.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**E. Horowitz, S. Sahni and D. Mehta,** Fundamentals of Data Structures in C++, 2nd Ed., University Press, 2016.
2.	**S. Sahni,** Data Structures, Algorithms, and Applications in C++, WCB/McGraw-Hill, 2005.
3.	**A. M. Tenenbaum,** Data Structures Using C, Pearson Ed, India, 1990.
4.	**N. Dale,** C++ Plus Data Structures, Jones & Bartlett Learning; 5th Ed. 2011
5.	**A. Drozdek,** Data Structures and Algorithms in C++, 4th Ed., Cengage Learning, 2013.
6.	**G.A.V PAI,** Data Structures and Algorithms, Concepts, Techniques and Applications, Volume1, 1st Edition, Tata McGraw-Hill, 2017.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K112.1	2	2	1	1					1	2	1	1
K112.2	2	2	1	1					1	2	1	2
K112.3	3	3	2	1			1		1	3	2	2
K112.4	3	3	2	1	1		2	1	2	3	2	3
Avg	3	3	3	1	1		2	1	2	3	2	2

Data Structures-LAB (23B25MA111)

Introduction to Algorithm and Data Structures, operations on Data Structures, Linear Data Structures, Linked Lists, Stacks, Queues, Nonlinear Data Structures, Tree, Binary Search Tree, Sorting and Searching.

Course Description

Course Code	**23B25MA111**	**Semester Even**	**Semester II Session - 2022-23** **Month from** Jan - June 2023
Course Name	Data Structures-LAB		

Credits	1	**Contact Hours**	0-0-2
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		
COURSE OUTCOMES After pursuing this course, the students will be able to:			**COGNITIVE LEVELS**
K137.1	demonstrate familiarity with major algorithms and data structures		Understanding Level (C2)
K137.2	apply the appropriate linear data structure (stack, queue, linked list) and algorithm design method for a specified application.		Applying Level (C3)
K137.3	apply sorting and searching techniques.		Applying Level (C3)
K137.4	analyze the concepts of nonlinear data structures such as trees and graphs.		Analyzing Level (C4)
Module No.	**Title of the Module**	**List of Experiments**	**No. of Labs for the module**
1.	Introduction to Algorithm and Data Structures	1. Write an algorithm to find factorial of a number. 2. Write an algorithm to write Fibonacci sequence. 3. Write an algorithm to solve Tower of Hanoi. 4. Write an algorithm to find the largest among three different numbers entered by user.	4
2.	Linear Data Structures	5. Implement stack operations using array. 6. Conversion from infix to postfix expression using stack 7. Evaluation of postfix expression. 8. Implement queue operations using array.	4
3.	Linked Lists	9. Implement operations on single linked list. 10. Implement operations on double linked list.	4

		11. Implement stack operations using linked list. 12. Implement queue operations using linked list.	
4.	Sorting and Searching	13. Implement selection sort, insertion sort, bubble sort, quick sort, merge sort in C++ 14. Implement Linear search and Binary search in C++	2
5.	Non-Linear Data Structures	15. Implement binary tree using arrays and perform binary traversals. i) Inorder ii) preorder iii) post order 16. Write a C++ program to balance a given tree.	2
		Total number of Labs	**16**

Evaluation Criteria

Components	**Maximum Marks**
Lab Test 1	20
Lab Test 2	20
TA	60 (Quiz, Assignments, Tests, Viva)
Total	**100**

Project based learning: A group of 2 to 3 students will be formed. Each group will have a group leader to develop coordination among the group members. A problem of sorting, searching or data structures implementation will be given. The group leader will submit a report of findings with output for the same.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**E. Horowitz, S. Sahni and D. Mehta,** Fundamentals of Data Structures in C++, 2nd Ed., University Press, 2016.
2.	**S. Sahni,** Data Structures, Algorithms, and Applications in C++, WCB/McGraw-Hill, 2005.
3.	**A. M. Tenenbaum,** Data Structures Using C, Pearson Ed, India, 1990.
4.	**N. Dale,** C++ Plus Data Structures, Jones & Bartlett Learning; 5th Ed. 2011
5.	**A. Drozdek,** Data Structures and Algorithms in C++, 4th Ed., Cengage Learning, 2013.
6.	**G.A.V PAI,** Data Structures and Algorithms, Concepts, Techniques and Applications, Volume1, 1st Edition, Tata McGraw-Hill, 2017.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K137.1	3	2	2	1			1		1	3	1	1
K137.2	3	2	2	1			1		2	3	1	2
K137.3	3	3	3	1			1		2	3	2	3
K137.4	3	3	3	1	1		2	2	2	3	2	3
Avg	3	3	3	1	2		1	2	2	3	2	2

Calculus (23B21MA112)

Sequence and Series, Successive differentiation and Leibnitz's theorem, Partial differentiation, Taylor's series expansion of functions of several variables, maxima and minima of functions of several variables, Jacobians, multiple integrals, gradient, divergence and curl, normal and tangent to a surface, line and surface integrals, Gauss and Stoke's theorems, second order linear ordinary differential equations.

Course Description

Course Code	**23B21MA112**	**Semester: Even**	**Semester II Session 2022-23 Month from Jan-June 2023**
Course Name	**Calculus**		
Credits	**4**	**Contact Hours**	3-1-0
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K122.1	explain the concepts of convergence of sequence and series.	Understanding Level (C2)
K122.2	make use of limits, continuity and differentiability in partial differentiation and solve the problems of maxima/minima.	Applying Level (C3)
K122.3	apply the concepts of double and triple integrals to find area and volume of curves and surfaces.	Applying Level (C3)

K122.4	make use of vector differentiation and integration to solve the problems related to Green's, Stoke's and Gauss divergence theorems.	Applying Level (C3)
K122.5	solve the second order linear ordinary differential equations with constant coefficients and Cauchy-Euler equation.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Sequence and Series	Sequence of real numbers, bounded and monotone sequences, convergence of sequences, Cauchy sequences, sub sequences, Bolzano-Weierstrass theorem. Series of real numbers, comparison test, ratio test, root test, alternating series, absolute and conditional convergence, uniform convergence, power series.	7
2.	Partial Differentiation	Concepts of limit and continuity, partial derivatives, Euler's theorem, Chain rule, change of variables, Total differential, Jacobians.	6
3.	Applications of Partial Differentiation	Taylor's Theorem, maxima and minima, Lagrange's method of multipliers, estimation of error and approximation of function of two variables.	5
4.	Multiple Integrals	Gamma and Beta functions, Double integral, change of order, change of variables, Triple integrals, Dirchilet integrals, applications.	8
5.	Vector Differential Calculus	Scalar and Vector point function, Gradient, Directional Derivative, Divergence, Curl and their applications.	4
6.	Vector Integral Calculus	Line integral, Surface integral and Volume integral, Applications to work done by the force, Green's, Stoke's and Gauss divergence theorems and their applications.	7
7.	Differential Equations	Linear differential equations of second order with constant coefficients, Cauchy-Euler equation.	5
Total Number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials)
Total	**100**

Project based learning: Each student in a group of 4-5 will apply the concepts of differential equations to solve real life practical problems.

Recommended Reading material:	
1.	**Jain, R. K. & Iyengar, S. R. K.,** Advanced Engineering Mathematics, 5th Ed., Narosa Publishing House, New Delhi, 2019.
2.	**Kreyszig, E.,** Advanced Engineering Mathematics, 10th Edition, John Wiley& Sons, Inc., 2015
3.	**Joel R. Hass, Christopher E. Heil, Maurice D. Weir,** Thomas Calculus, 14th Ed., Pearson Education Asia (Addison Wesley), New Delhi, 2018.
4.	**Goldberg, R. R.,** Methods of Real Analysis, Oxford Publication, 1976.
5.	**Malik S. C.& Arora, S.** Mathematical Analysis, New Age International, 2010.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K122.1	1	2	1						1			
K122.2	1	2	1						1			
K122.3	1	2	1						2			
K122.4	1	2	1		1				2			
K122.5	1	2	2		2		2		2			
Avg	1	2	1		2		2		2			

Physics 2 (15B11PH211)

Gauss's Law and applications, Laplace and Poisson's Equations, Maxwell's Equations, Electromagnetic Waves, Poynting's theorem (derivation) and Poynting vector, Propagation of Electromagnetic waves in Free Space and Dielectric Media, normal and oblique incidence, Total internal Reflection and Brewster's Law, Lasers, Principle and Working of Ruby Lasers, Optical Fiber and their applications, Bonding in solids, Crystal Structure, Bragg's Law and X-ray Diffraction, Classical theory: Free electron theory of metals, Quantum theory of electronic conduction, Kronig Penney Model, Brillouin zone, Band Theory, Distinction between metals, Semiconductors and insulators on the basis of band theory of solids, Effective Mass.

Course Description

Course Code	15B11PH211	**Semester: Even**	**Semester: II** **Session 2022-23** **Month from: Jan to June 2023**
Course Name	Physics 2		

Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s)		

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
C102.1	Recall the basic concepts relating to electromagnetic theory, lasers, fiber optics and solid state physics.	Remembering Level (C1)
C102.2	Illustrate the various physical phenomena with interpretation based on the mathematical expressions involved.	Understanding Level (C2)
C102.3	Apply the basic principles in solving a variety of problems related to lasers, electromagnet theory, fiber and solid state physics.	Applying Level (C3)
C102.4	Analyze and examine the solution of the problems using physical and mathematical concepts involved in the course.	Analyzing Level(C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Electromagnetism**	Introduction of electromagnetism, Basic idea of Cartesian, Spherical polar and cylindrical coordinate systems, Basics of fields, Gradient, Divergence and Curl, Coulomb's law, Electric Flux & Gauss's law, Applications of Gauss law for Spherical and Cylindrical symmetries (all important cases), Electric field due to charged conductor, Force per unit area on the surface of the charged conductor, Laplace and Poisson's equations and their applications to solve electrostatic problems in Cartesian and cylindrical systems, Treatment of electrostatic problems using Laplace and Poisson's equations in spherical coordinate system, Maxwell's correction to Ampere's law, Displacement current, Maxwell's equations in free space and dielectric media (both differential and integral forms) Poynting's theorem (derivation) and Poynting vector, Electromagnetic waves in free	17

		space (equations and solutions) and Transverse nature of EM waves, Energy and momentum in EM waves, Radiation pressure, Propagation of EM waves through boundary, Boundary Conditions across the medium ,Reflection and Transmission of EM waves at normal incidence, Reflection and Transmission at oblique incidence- Laws of Reflection and Refraction , Oblique incidence-p polarization, Fresnel's equations, Total internal Reflection and Brewster's Law for EM waves	
2.	**Lasers, Optical Fiber and their applications**	Introduction to Laser, spontaneous and stimulated emission, population inversion, Einstein A and B coefficients, Principles and working of lasers, Three level Laser Scheme, Ruby laser, Applications of lasers , Concept of optical fiber and Principle of Total Internal Reflection in optical fiber, Numerical aperture and Single, multistep & graded index fiber, Attenuation coefficient, Transmission losses in optical fiber, Applications of an optical fiber: Endoscopy and sensing applications (discussion of one specific example) of an optical fiber.	08
3.	**Solid State Physics**	Basic ideas of Bonding, Ionic bonding, covalent bonding and Metallic Bonding, Inter-atomic coulomb forces in ionic crystals and Determination of equilibrium separation, Minimum Potential energy and determination of Madelung constant 'α 'for NaCl crystal in 1D , Lattice points and space lattice, Basis and crystal structure, Unit cell and Primitive cell, Seven crystal systems and Fourteen, Bravais	15

		space lattice, Coordination number, nearest neighbor distance, atomic radius and packing factor in crystal structure, Calculation of lattice constant, Lattice planes and Miller indices, Separation between lattice planes, Derivation and examples, X-ray diffraction, Bragg's law of X- ray diffraction, Electrical properties of metals: Classical free electron theory of conduction in metals, Quantum mechanical treatment: Quantum theory of electronic conduction in metals, Kronig Penney Model: Periodic Potential and Allowed Energies, Emergence of Bands through Kronig Penney Model and Band Theory of Solids, Distinction between metals, Semiconductors and insulators, intrinsic and extrinsic semiconductors, Effective Mass: Concept and Significance, Brillouin zone: Relation with Lattice Structures, Types of Brillouin zones, Energy and Momentum ,Brillouin zone: Origin of Forbidden Bands	
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, etc.)
Total	100

Project Based Learning: The students will do projects on applications of electromagnetic theory, lasers, fiber optics and solid state physics. This will help them identify the role of physics in industries related to optical communication, medicine and electronics.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	D. J. Griffiths, *Introduction to electrodynamics*, 4th illustrated revised edition, Pearson India 2019
2.	G. Keiser, *Optical Fiber Communications*, Tata Mc Graw Hill Education 2013
3.	A. Beiser, *Concepts of Modern Physics*, 6th revised edition, Mc Graw Hill International 2002
4.	S. O. Pillai, *Solid State physics*, 8th Edition, New Age International (P) Limited 2018
5.	B. G. Streetman & S. Banerjee, *Solid State Electronic Devices*, 7th illustrated edition, Prentice-Hall India 2015

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
C102.1	1	1	1				1		1			
C102.2	2	1	1				1		1			
C102.3	2	2	1				1					
C102.4	2	2	2				1					
Avg												

Environmental Science (23B12BT111)

The Multidisciplinary nature of environment, principles of Biodiversity & conservation, overview of various Natural resources including Energy, their consumption & conservation strategies, different forms of Pollution, hazardous waste management, Urban planning, Disaster management, Environmental Policies, Laws, Regulations, ethics and a Field Work component that appraises students with issues in environment in current context.

Course Description

Subject Code	23B12BT111	**Semester: Even**	**Semester: II Session: 2022-2023** **Month from: JAN-JUN**
Subject Name	**Environmental Science**		
Credits	**2**	**Contact Hours**	**2-0-0**
	Coordinator(s)		

Faculty (Names)	Teacher(s) (Alphabetically)	

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		COGNITIVE LEVELS
K156.1	explain fundamental principles of environment, ecosystem resources, biodiversity and conservation.	Understand Level (C2)
K156.2	identify hazards related to environmental pollution and learn environmentally safe and sustainable practices.	Apply Level (C3)
K156.3	interpret modern techniques for Disaster management, global environmental concerns, Government regulations, Environmental Policies, Laws & ethics.	Understand Level (C2)
K156.4	make use of ground situation on specific environmental aspects, examine risks involved, make a field report and present the findings.	Apply Level (C3)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	The Multidisciplinary nature of environment	Definition, scope and importance, Need for public awareness, Types of Ecosystems, World Biomes, Ecosystem functioning, Case studies.	3
2.	Biodiversity & conservation	Diversity of flora and fauna, species and wild life diversity, Biodiversity hotspots, threats to biodiversity, Case studies	3
3.	Natural resources, Energy consumption & conservation	Water, Land, Energy (Renewable, non-renewable, wind, solar, hydro, Biomass) resources, Global Conventions on Energy, Kyoto protocol, Case studies.	8
4.	Pollution, hazardous waste management	Air, Water & Land, pollution, sources & causes, effects, Electronic waste, nuclear hazards, Case studies.	6
5.	Urban planning, Disaster management	Sustainable building, Disaster Management and Contingency Planning, Critical issues concerning Global environment Urbanization, global warming, climate change, acid rain, ozone depletion etc Case studies	4

6	Environmental Policies, Laws, Regulations & ethics	Environmental Policy and laws, Different Acts such as: Environmental Protection Act, Air and Water Acts, Wildlife and Forest Acts), SPCB and CPCB, their roles and responsibilities.	4
7	Field Work/	Explore the current environment related occurrences at national and international level, Study of successful sustainable measures, a know-how of industries in local region and their possible effects, measure of water, air and land quality, Visit to a local polluted site-Urban/Rural /Industrial / Agricultural, Study of simple ecosystems.	2
		Total number of Lectures	**30**

Evaluation Criteria

Components	**Maximum Marks**
Mid	30
End	40
Teachers Assessment (TA)	30
Total	**100**

PBL: Visit to a local polluted site-Urban/Rural /Industry/Agricultural, Survey ground situation on specific environmental aspects, and their possible impacts on water, air and land quality, identify risks involved, make a field report and present the findings

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Benny Joseph, Environmental Studies Simplified, 3rd Edition, McGraw Hill Education, India, Published 2nd August, 2017
2.	Erach Bharucha, Textbook of Environmental Studies for UG Courses, 3rd Edition, Orient Black Swan, Published 1st Jan 2013
3.	Issues of the Journal: Down to Earth, Published by Centre for Science and Environment (CSE), Delhi

CO-PO and CO-PSO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**
K156.1					3							
K156.2				1	2	3		1	2			
K156.3				2	2	3		1	2			

K156.4					3	2	2	3	2			
Avg				2	3	3	2	2	2			

Object Oriented Analysis and Design- Project Based Learning (23B56CS123)

Course Description

Subject Code	23B56CS123	**Semester Even**	**Semester: II Session: 2022- 2023 Month from Jan to June 2023**
Subject Name	Object Oriented Analysis and Design- Project Based Learning		
Credits	**2**	**Contact Hours**	0-0-4
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K166.1	explain object-oriented programming fundamentals	Understand Level (C2)
K166.2	interpret logic building of real case studies solution using object-oriented concepts	Understand Level (C2)
K166.3	develop and experiment with programs using object-oriented programming.	Apply Level (C3)
K166.4	develop and integrate project in a team	Apply Level (C3)
K166.5	evaluate technical report detailing the problem statement, proposed methodology, software specification, design specifications, test plan, and implementation details.	Evaluate Level (C5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Labs for the module**
1.	Fundamentals of C++	Basic C++ Programming, Basic Data Type, User defined data type, operators, type cast, expressions, Functions	4

2	Introduction to OOAD with C++	Object Model, Object Modeling Technique(OMT), Classes and Objects, Responsibilities, Relationships	4
3	Object Oriented Design and Analysis using UML	Use Case Diagrams, Class Diagram, Sequence Diagram, State Diagrams, Collaboration Diagrams	4
4	OOAD Implementation	Object oriented concepts and programming using C++	4
5	Advanced OOAD implementation	Inheritance, Polymorphism, templates, STL, sorting and searching	4
6	OOAD Case studies	Apply and Experiment OOAD in different context	4
7	Project	Analyze and identify various OOAD principles for project Develop, design, implementation, plan, demonstrate	3
8	Prepare technical report	Prepare technical report detailing the problem statement, proposed methodology, software specification, design, test plan, and implementation detail	3
		Total number of Labs	**30**

Evaluation Criteria

Components	**Maximum Marks**
Assessment	40
Viva Voice of Project (Mid and Final)	35
End Semester Report + Presentation	15
Attendance	10
Total	**100**

Project based learning: Project is an integral part of the lab. Students form a group (of size 3), and discuss their project ideas with their faculty before finalizing their research areas. The project is done using object-oriented programming language and develops applications ranging from basic to advanced problem statements. This helps students in understanding the working of project development in companies and also broadens the spectrum for team work and procedural implementation of projects in hand to be delivered to clients as per the requirements.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K166.1	3	2							2			
K166.2	1	3	1		1	1	2	2	2	1	1	1
K166.3	2		3	2			1		2			
K166.4	1		2	2	1	1	2		2	2	2	
K166.5	2	1	1	1	2	2	3	2	2	1	1	2
Avg	2	2	2	2	2	2	2	2	2	2	2	2

UNIX Workshop (23B58CS125)

The course lays emphasis on UNIX environment. A number of concepts are taught in UNIX which aids in managing network systems such as file, web, database, printer, etc servers. It is increasingly used in engineering and design and for some home users. The most common use is in networks administration and security.

Course Description

Course Code	**23B58CS125**	**Semester: Even**	**Session: 2022-23** **Month from: Jan - June 2023**
Course Name	UNIX Workshop		
Credits	2	**Contact Hours**	1-0-2
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K176.1	demonstrate use of common Unix/Linux commands	Understanding Level (Level 2)
K176.2	apply Unix/Linux file redirection and pipelining to combine utilities to perform complex tasks	Apply Level (Level 3)
K176.3	develop shell scripting using Selection, Case & Conditional Statements	Apply Level (Level 3)
K176.4	build shell scripts to solve various problems using commands like grep, line number, test, expressions, compare, command line input, etc.	Apply Level (Level 3)

K176.5	build and manage files and directories, file permissions, and navigate the Unix/Linux file system	Apply Level (Level 3)

Module No.	Title of the Module	List of Experiments	No. of Labs for the module
1.	The UNIX File System & Basic Commands	1. Understanding the UNIX File System & Execute Basic Commands: To make a study of UNIX Environment and execute basic commands.	1
2.	UNIX Editor & Operations	2. Working with UNIX Editor & understand UNIX processes Operations: To understand working with UNIX Editor and UNIX Processes, Process Utilities.	1
3.	UNIX File Handling & Regular Expressions	3. Working with Directories: To work with Directories such as creation, searching, moving, deleting etc. 4. Working with Files: To work with Files such as creation, searching, moving, deleting etc. 5. Using Regular Expressions for Searching: Using Regular Expressions for Searching in a File or Directory.	3
4.	UNIX Advanced Filters	6. Working with UNIX pipe: Using UNIX pipe to connect two or more commands. 7. Working with UNIX filters: Working with filters to process text in different ways. 8. Working with UNIX advance filters: Working with advance filters, performing Advanced Pattern Matching with Stream-oriented & Non-Interactive Text Editor.	3
5.	UNIX Shell Scripting	9. Working with UNIX Shell: Working with UNIX Shell for basic problems using variables and naming conventions. 10. Performing UNIX Shell Scripting: Performing UNIX Shell Scripting with Conditional Constructs, Looping Statements, Arrays, Functions for problem solving.	2
6.	UNIX Administration	11. Performing Document handling through Shell Scripting – Performing Document Handling, Quoting, and Parsing text. 12. Working with UNIX Administration: Working with UNIX Administration, Login Process, Users & Permission and Process Management.	2
		Total number of Labs	**12**

Evaluation Criteria	
Components	**Maximum Marks**
Mid	30
End	40
Day-to-Day	30 (Quiz + Assignment + Class Test + Attendance)

Total	**100**
Project based learning: Each student in a group of 2 will apply the advanced programming concepts in UNIX Environment to solve practical problems.	
Text Books	
1.	Richards Stevens, Advanced Programming in the UNIX Environment, Pearson Education India, 2005
2.	Sumitabha Das, UNIX Concepts & Applications, 4th Edition, Tata McGraw-Hill Education, 2008
Reference Books	
1.	Maurice J. Bach, Design of UNIX Operating System, Prentice-Hall, 1986
2.	Marc J. Rochkind, Advanced UNIX Programming, 2nd Edition, Pearson Education, 2004
3.	Evi Nemeth, Garth Snyder, Trent R. Hein, Unix and Linux System Administration Handbook, 4th Edition Pearson Education India, 2011
4.	Richards Stevens, Unix Network Programming, Addison-Wesley Professional, 2004

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K176.1	2	1	1	1			1	1	1	2	2	2
K176.2	2	1	2	1			1	1	1	2	2	2
K176.3	2	2	2	1			1	1	1	2	2	2
K176.4	2	2	2	1			1	1	1	2	2	2
K176.5	2	1	1	1			1	1	1	2	2	2
Avg	2	2	2	1			1	1	1	2	2	2

Third Semester

Operating System (23B21MA211)

Introduction to System Programs & Operating Systems, Evolution of Operating System. Concept, Process Control Blocks (PCB), Scheduling criteria Pre-emptive & non Pre-emptive process scheduling, Scheduling algorithms. Memory Hierarchy, Concepts of memory management. File Management and Distributed operating system and Security Concept.

Course Description

Course Code	23B21MA211	Semester Odd	Semester III Session 2022-23 Month from Jul 2023 to Dec 2023
Course Name	OPERATING SYSTEM		
Credits	3	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		COGNITIVE LEVELS
K201.1	describe and explain the fundamental components of operating systems and system programming.	Understand Level (C2)
K201.2	apply and compare various policies of scheduling in processes and threads in OS.	Apply Level (C3)
K201.3	explain various resource management techniques of operating systems and compare their performances.	Understand Level (C2)
K201.4	understand the concept of IPC and apply various process synchronization techniques in OS.	Apply Level (C3)
K201.5	discuss the working of IO management and apply various disk scheduling techniques.	Apply Level (C3)
K201.6	analyze and report appropriate OS design choices for building real-world systems.	Analyze Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1	**Introduction**	Introduction to System Programs & Operating Systems, Evolution of Operating System (mainframe, desktop, multiprocessor, Distributed, Network Operating System, Clustered & Handheld System), Operating system services, Operating system structure, System Call & System Boots, Operating system design & Implementations, System protection, Buffering & Spooling. Types of Operating System: Bare machine, Batch Processing, Real-Time, Multitasking & Multiprogramming, time-sharing system.	10
2	**Process Management**	Concept, Process Control Blocks (PCB), Scheduling criteria Pre-emptive & non Pre-emptive process scheduling, Scheduling algorithms, algorithm evaluation, multiple-processor scheduling, real time scheduling, operations on processes, threads, inter-process communication, precedence graphs, critical section problem, semaphores, classical problems of synchronization. Deadlock: Characterization, Methods for deadlock handling, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.	10

3	**Memory Management**	Memory Hierarchy, Concepts of memory management, MFT & MVT, logical and physical address space, swapping, contiguous and non-contiguous allocation, paging, segmentation, and paging combined with segmentation. Structure & implementation of the Page table. Concepts of virtual memory, Cache Memory Organization, demand paging, page replacement algorithms, allocation of frames, thrashing, demand segmentation	8
4	**File Management**	concepts, access methods, free space management, allocation methods, directory systems, protection, organization, sharing & implementation issues, Disk & Drum Scheduling, I/0 devices organization, I/0 buffering, I/O Hardware, Kernel I/O subsystem, Transforming I/O request to hardware operations. Device Driver: Path managements, Submodule, Procedure, Scheduler, Handler, Interrupt Service Routine. File system in Linux & Windows	8
5	**Distributed operating system and Security Concept**	Types, Design issues, File system, Remote file access, RPC, RMI, Distributed Shared Memory (DSM), Basic Concept of Parallel Processing &Concurrent Programming, Introduction to distributed operating systems, design goal of distributed OS. Security & threats protection: Security violation through Parameter, Computer Worms & Virus, Security Design Principle, Authentications, Protection Mechanisms. Case study of Unix, Linux & Windows.	6
		Total number of Lectures	42

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials)
Total	**100**

Project based learning: A group of 3 to 4 students will be formed. Each group will have a group leader to develop coordination among the group members. Each group will be assigned a problem related to Operating Systems e.g. Scheduling criteria Pre-emptive & non Pre-emptive process scheduling, Scheduling algorithms. Memory Hierarchy, Concepts of memory management. File Management and Distributed operating system and Security Concept. The group leader of each group will submit a report and then finally each member of the group will be evaluated through a viva voce.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	A. Silberschatz,, P. B. Galvin, and G. Gagne, Operating System Concepts, John Wiley (2018), 10th ed.

2.	W. Stallings, Operating Systems Internals and Design Principles, Prentice Hall (2020), 9th ed.
3.	D.M. Dhamdhere, Operating Systems: A Concept Based Approach, McGraw Hill (2009), 2nd ed
4.	A.S. Tanenbaum "Operating Systems Design and Implementation", Third Edition, Prentice Hall Publications 2015.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K201.1	2	2	2	3	1		1	1	2	3	3	3
K201.2	3	3	3	2	1		2	1	2	3	3	3
K201.3	3	3	3	2	1		2	1	2	3	3	3
K201.4	2	2	2	3	1		1	1	2	3	3	3
K201.5	3	3	3	2	1		2	1	2	3	3	3
K201.6	3	3	3	2	2		2	1	3	3	3	3
Avg	**3**	**3**	**3**	**3**	**2**		**2**	**1**	**3**	**3**	**3**	**3**

Operating System Lab (23B25MA211)

Introduction to Unix Systems and commands, Process Control Blocks (PCB), Scheduling criteria Pre-emptive& non Pre-emptive process scheduling, Scheduling algorithms. Pthreads, Synchronizations concepts, Memory Hierarchy, memory management Policies.

Course Description

Course Code	**23B25MA211**	**Semester Odd**	**Semester III Session 2023-24 Month from Jul 2023 to Dec 2023**
Course Name	**Operating System Lab**		
Credits	**1**	**Contact Hours**	**0-0-2**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K231.1	infer various Unix Commands.	Understand Level (C2)
K231.2	develop programs to create different types of processes using pthread library under Linux environment.	Apply Level (C3)
K231.3	develop programs to implement resource management task like CPU scheduling algorithms, deadlock handling.	Apply Level (C3)

K231.4	develop programs to implement and test various synchronization techniques like semaphores, binary semaphore and monitors via different classical test suites.	Apply Level (C3)
K231.5	analyze different memory management policies	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Unix**	Unix Commands-files,-access, open, close, append, read write, pipes, filter, system calls, directory commands, terminal commands, environment commands	3
2.	**Process and Threads**	Process creation/ Inter process communication (IPC) – POSIX thread library, pthread join, threads with global variables, pthread condition variables, parent child processes, zombie process, orphan process	3
3.	**CPU Scheduling**	Resource management tasks like CPU scheduling algorithms, deadlock handling. - FCFS, Priority, Preemptive Priority, Round Robin, SJF, SRJF, MLFQ , Bankers algorithm,	3
4.	**Synchronization**	Synchronization techniques like semaphores, binary semaphore and monitors via different classical test suites, readers writers problem, dining philosophers problem.	3
5.	**Memory Management Policies**	Memory management policies implementation-Best Fit, First fit, Worst Fit page replacement algorithms	2
		Total number of Labs	**14**

Evaluation Criteria

Components	**Maximum Marks**
Mid Viva	20
End Viva	20
TA	60
Total	**100**

Project based learning: A group of 4 to 5 students will be formed. Each group will have a group leader to develop coordination among the group members. Each group will be assigned a problem related to Operating Systems Concepts e.g. Scheduling criteria Pre-emptive & non Pre-emptive process scheduling, Scheduling algorithms. Memory Hierarchy, Concepts of memory management. File Management and Distributed operating system and Security Concept. The group leader of each group will submit a report and then finally each member of the group will be evaluated through a viva voce.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	A. Silberschatz, P.B. Galvin and G. Gagne, Operating System Concepts, John Wiley (2018), 10th edition.
2.	W. Stallings, Operating Systems Internals and Design Principles, Prentice Hall (2020), 9th edition.
3.	D.M. Dhamdhere, Operating Systems: A Concept Based Approach, McGraw Hill (2009), 2nd edition.

4.	A. S. Tanenbaum "Operating Systems Design and Implementation", Third Edition,Prentice Hall Publications 2015.
5.	G. Nutt, "Operating Systems – A modern perspective", Pearson Education, 2nd Edition 2002.
6.	D. Solomon, M. Russinovich, "Inside Microsoft Windows 2000", 3rd Edition, Micorosoft Press, 2002.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K231.1	2	2	2	2	1		1	1	2	3	3	3
K231.2	3	3	3	2	1		3	1	2	3	3	3
K231.3	3	3	3	2	1		3	1	3	3	3	3
K231.4	3	3	3	2	1		3	1	3	3	3	3
K231.5	3	3	3	3	1		3	1	3	3	3	3
Avg	**3**	**3**	**3**	**3**	**1**		**3**	**1**	**3**	**3**	**3**	**3**

Web Technology (23B21MA212)

Review of Essential topics in Web Development, Web development in design of web pages using XML and CSS, Developing dynamic web pages using Java Script, Databases and PHP, Database Connectivity using MYSQL

Course Description

Course Code	**23B21MA212**	**Semester Odd**	**Semester III Session 2023-24 Month from Jul 2023 to Dec 2023**
Course Name	**Web Technology**		
Credits	**3**	**Contact Hours**	**3-0-0**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K202.1	apply the fundamental elements of Web development in design of web pages using HTML (static web pages)	Apply Level (C3)
K202.2	apply the fundamental elements of Web development in design of web pages using XML and CSS	Apply Level (C3)
K202.3	demonstrate the web development concepts built on Advanced Java Scripting (dynamic web pages)	Understand Level (C2)

K202.4	make use of functional aspects of database handling to create database using PHP	Apply Level (C3)
K202.5	utilize MYSQL for database connectivity with Web pages	Apply Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1	Review of Essential topics in Web Development	Introduction to HTML Programming: The Basics (Head, Body, Colors, Attributes), Lists: ordered and unordered, Links: Introduction Relative Links, Absolute Links and Link Attributes, Images, Tables, Forms	8
2	Web development in design of web pages using XML and CSS	Introduction: Understanding Mark-up Languages, Introduction to XML and its Goals. XML Basics: XML Structure and Syntax, Document classes and Rules. Other XML Concepts: Scripting XML, XML as Data, Linking with XML. XML with Style: XSL –Style Sheet Basics, XSL basics, XSL style sheets. Cascading style sheet (css) for text formatting and other manipulations.	8
3	Developing dynamic web pages using Java Script	Data types and variables, functions, methods and events, controlling program flow, JavaScript object model, built-in objects and operators.	8
4	Databases and PHP	PHP: Starting to script on server side, Arrays, function and forms, advance PHP. Databases: Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs, Database Connectivity with PHP	10
5	Database Connectivity using MYSQL	Database connectivity of forms with back end tool using MYSQL, populating the data in text boxes, list boxes etc. searching of data in database using forms. Updating/ editing of data based on a criterion.	8
		Total number of Lectures	**42**

Evaluation Criteria Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials)
Total	**100**

Project based learning: A group of 4-5 students will develop a web application using any of the web technologies (either single or in combination) covered as part of this course. Students will be required to develop a secure web application having countermeasures implemented against web hacks like XSS, CSRF, injection attacks, DOS attacks etc. Building a web application using advanced JS scripting and/ or web frameworks, while handling the various facets of cyber security will give

students hands on experience of working in the area of web technology and cyber security. The knowledge gained will enhance their employability in the IT sector.	
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	V. DeBolt, Integrated HTML and CSS A Smarter, Faster Way to Learn Wiley / Sybex, 2006.
2.	C. Williams, C. Williams Introduction to HTML and CSS, O'Reilly, 2015
3.	HTML A Beginner's Guide, Tata McGraw-Hill Education, 5th edition 2013.
4.	J. A. Ramalho, Learn Advanced HTML 4.0 with DHTML, BPB Publications, 2007
5.	S. Holzner, PHP: The Complete Reference Paperback, McGraw Hill Education (India), 2008.
6.	R. Nixon, Learning PHP, MySQL, JavaScript, CSS & HTML5, 3rd edition Paperback, O'reilly, 2014.
7.	D. Sklar, A. Trachtenberg, PHP Cookbook: Solutions & Examples for PHP Programmers, 2014.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K202.1	3	3	3	2	1		2	1	2	3	3	3
K202.2	3	3	3	2	1		2	1	2	3	3	3
K202.3	2	2	2	2	1		1	1	2	3	3	3
K202.4	3	3	3	2	1		3	1	3	3	3	3
K202.5	3	3	3	2	1		2	1	2	3	3	3
Avg	**3**	**3**	**3**	**2**	**1**		**2**	**1**	**3**	**3**	**3**	**3**

Web Technology Lab (23B25MA212)

Review of Essential topics in Web Development, Web development in design of web pages using XML and CSS, Developing dynamic web pages using Java Script, Databases and PHP, Database Connectivity using MYSQL.

Course Description

Subject Code	**23B25MA212**	**Semester Odd**	**Semester III Session 2023-24 Month from Jul 2023 to Dec 2023**
Subject Name	**Web Technology Lab**		
Credits	**1**	**Contact Hours**	**0-0-2**
	Coordinator(s)		

Faculty (Names)	Teacher(s) (Alphabetically)	

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		COGNITIVE LEVELS
K232.1	apply the fundamental elements of Web development in design of web pages using HTML (static web pages)	Apply Level (C3)
K232.2	apply the fundamental elements of Web development in design of web pages using XML and CSS	Apply Level (C3)
K232.3	demonstrate the web development concepts built on Advanced Java Scripting (dynamic web pages)	Understand Level (C2)
K232.4	make use of functional aspects of database handling to create database using PHP	Apply Level (C3)
K232.5	utilize MYSQL for database connectivity with Web pages	Apply Level (C3)

Module No.	Subtitle of the Module	Topics in the module	No. of Labs
1.	Review of Essential topics in Web Development	Introduction to HTML Programming: The Basics (Head, Body, Colors, Attributes), Lists: ordered and unordered, Links: Introduction Relative Links, Absolute Links and Link Attributes, Images, Tables, Forms	3
2.	Web development in design of web pages using XML and CSS	Introduction: Understanding Mark-up Languages, Introduction to XML and its Goals. XML Basics: XML Structure and Syntax, Document classes and Rules. Other XML Concepts: Scripting XML, XML as Data, Linking with XML. XML with Style: XSL –Style Sheet Basics, XSL basics, XSL style sheets. Cascading style sheet (css) for text formatting and other manipulations.	3
3.	Developing dynamic web pages using Java Script	Data types and variables, functions, methods and events, controlling program flow, JavaScript object model, built-in objects and operators.	3
4.	Databases and PHP	PHP: Starting to script on server side, Arrays, function and forms, advance PHP. Databases: Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs, Database Connectivity with PHP	2

5.	Database Connectivity using MYSQL	Database connectivity of forms with back end tool using MYSQL, populating the data in text boxes, list boxes etc. searching of data in database using forms. Updating/ editing of data based on a criterion.	3
		Total number of Labs	**14**

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day to Day	60
Total	**100**

Project based learning: A group of 4-5 students will develop a web application using any of the web technologies (either single or in combination) covered as part of this course. Students will be required to develop a secure web application having countermeasures implemented against web hacks like XSS, CSRF, injection attacks, DOS attacks etc. Building a web application using advanced JS scripting and/ or web frameworks, while handling the various facets of cyber security will give students hands on experience of working in the area of web technology and cyber security. The knowledge gained will enhance their employability in the IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	V. DeBolt, Integrated HTML and CSS A Smarter, Faster Way to Learn Wiley / Sybex, 2006.
2.	C. Williams, C. Williams Introduction to HTML and CSS, O'Reilly, 2015
3.	HTML A Beginner's Guide, Tata McGraw-Hill Education, 5th edition 2013.
4.	J. A. Ramalho, Learn Advanced HTML 4.0 with DHTML, BPB Publications, 2007
5.	S. Holzner, PHP: The Complete Reference Paperback, McGraw Hill Education (India), 2008.
6.	R. Nixon, Learning PHP, MySQL, JavaScript, CSS & HTML5, 3rd edition Paperback, O'reilly, 2014.
7.	D. Sklar, A. Trachtenberg, PHP Cookbook: Solutions & Examples for PHP Programmers, 2014.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K232.1	3	3	3	2	1		2	1	2	3	3	3
K232.2	3	3	3	2	1		2	1	2	3	3	3
K232.3	2	2	2	2	1		1	1	2	3	3	3
K232.4	3	3	3	2	1		3	1	3	3	3	3
K232.5	3	3	3	2	1		2	1	2	3	3	3
Avg	**3**	**3**	**3**	**2**	**1**		**2**	**1**	**3**	**3**	**3**	**3**

Probability and Statistics (15B11MA302)

Representation of data, measures of central tendency, dispersion, skewness and kurtosis, permutations and combinations, axioms of probability, conditional probability, multiplication and addition theorems, Baye's theorem, random variable, discrete and continuous distributions, Binomial, Uniform, Normal and Poisson distributions, elementary sampling theory, test of hypothesis and significance, curve fitting by the method of least squares, correlation and regression.

Course Description

Course Code	**15B11MA302**	**Semester Odd**	**Semester III Session 2023-24 Month from Jul 2023 to Dec 2023**
Course Name	**Probability and Statistics**		
Credits	**4**	**Contact Hours**	**3-1-0**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C202.1	demonstrate different diagrammatic representation of data and explain the measures of central tendency, dispersion and asymmetry.	Understand Level (C2)
C202.2	explain the concepts of probability theory and Bayes' theorem.	Understanding Level (C2)
C202.3	explain and solve the problems of probability distributions along with their mean, variance & moment generating functions.	Apply Level (C3)
C202.4	explain sampling theory and apply test of hypothesis on small and large samples.	Apply Level (C3)
C202.5	apply the method of least squares for curve fitting and explain correlation and regression.	Apply Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Classification of Data	Classification of data, graphic and diagrammatic representation of data, measures of central tendency and dispersion i.e. mean and standard deviation, measures of skew ness and kurtosis.	6
2.	Probability	Sample space and events, Permutations and combinations, Probability of an event, Axioms of probability, Equiprobable spaces, Conditional probability, Multiplication and addition theorems, Bayes' theorem, independent events.	10
3.	Random Variables	Random Variable, Discrete and continuous distributions, Mean and variance of a random variable	4
4.	Probability Distributions	Binomial, Uniform, Normal and Poisson distributions.	8
5.	Sampling Theory	Test of hypothesis and significance. Test based on Exact (Small) Sampling- Chi-square test, t test and F test.	10

6.	Correlation and Regression	Curve fitting by the method of least squares, Correlation and regression.	4
		Total number of Lectures	**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project Based Learning: Each student in a group of 7-8 students will apply the concepts of sampling theory, correlation and regression to solve some real life problems.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	R.E. Walpole, R.H. Myers, S.I. Myers and K. Ye., Probability and Statistics for Engineers and Scientists, 8th edition, Pearson, 2007.
2.	A. Papoulis, S.U. Pillai, Probability, Random Variables and Stochastic Processes, Tata McGraw-Hill, 2002.
3.	M.R. Spiegel, Statistics (Schaum's oulines), McGraw-Hill, 1995.
4.	T. Veerarajan, Probability, Statistics and Random Processes, 3rd edition Tata McGraw-Hill, 2008.
5.	R.A. Johnson, Miller and Freund's Probability and Statistics for Engineers, 8th edition, PHI Learning Private limited, 2011.
6.	S. Palaniammal, Probability and Random Processes, PHI Learning Private limited, 2012.

CO-PO and CO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
C202.1	**3**	**2**	**1**	**2**					**2**	**1**	**1**	**1**
C202.2	**2**	**2**	**1**	**1**					**2**	**1**	**1**	**1**
C202.3	**3**	**3**	**1**	**1**					**2**	**1**	**1**	**1**
C202.4	**3**	**3**	**3**	**2**			**2**	**1**	**2**	**1**	**1**	**1**
C202.5	**3**	**3**	**2**	**2**			**2**	**1**	**2**	**1**	**1**	**1**
Avg	**3**	**3**	**2**	**2**			**2**	**1**	**2**	**1**	**1**	**1**

Communication Skills Lab (23B25HS211)

Practical for Learning Comprehension Strategies of Reading through Activities, Practical for Mastering the Skill of Listening through Activities, Activities for enhancing speaking skills in Communication, Public Speaking, Different forms of writing, Precis Writing, Picture Composition, Software based learning of reading and pronunciation skills.

Course Description

Course Code	**23B25HS211**	**Semester Odd**	**Semester III Session 2023-24 Month from Jul 2023 to Dec 2023**
Course Name	**Communication Skills Lab**		
Credits	**1**	**Contact Hours**	**0-0-2**

Faculty (Names)	Coordinator(s)	
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		COGNITIVE LEVELS
K241.1	demonstrate good comprehension skills through proper reading of any form of write-up.	Understand Level (C2)
K241.2	examine relevant and unspoken points while listening to any talk or conversation.	Analyze Level (C4)
K241.3	develop good public speaking skills and organize one's thoughts while communicating with others.	Apply Level (C3)
K241.4	make use of Professional competencies to construct different forms of writing and implement it in professional conduct.	Apply Level (C3)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	**Reading**	Practicals for Learning Comprehension Strategies of Reading through Activities: • Summarizing • Sequencing • Inferencing • Comparing and contrasting; Drawing conclusions • Self-questioning • Problem-solving; • Newspaper reading and comprehension • Relating background knowledge • Distinguishing between fact and opinion • Finding the main idea, important facts, and supporting details	3
2.	**Listening**	Practicals for Mastering the Skill of Listening through Activities: • Listening for the Main Idea; Listening for Detail: 5 Ws and H questions; Listening in sequence: for order following Through Ted Talks • Listening with vocabulary through Bingo • Listening for understanding personal & social connotations through News Brief, Interviews. Skill Development & Employability • Listening for non-verbal connotations through Audio-Videos and Movie Clips • Podcast Listening and summarising talks as per evaluative or appreciative listening Podcast	3
3.	**Speaking**	Activities for enhancing speaking skills in Communication:	3

		• Spoken vs. Written language- Formal and Informal English (Bingo); • Practice through JAM Session- Situational Dialogues – Greetings – Taking; Leave – Introducing Oneself and Others. Making Requests and Seeking Permissions - Telephone Etiquette. Skill Development & Employability Activities for learning Public Speaking: • Exposure to Structured Talks - Non-verbal Communication: Practice • Re-creating situations through Role-Play- Expressions in Various Situations; • Practice delivering a Short Speech, Extempore and Group Discussions Skill Development & Employability	
4.	**Writing**	Grammar Practice & Exercises: • Jumbled Paragraphs for grammar learning • Picking the Out of Context sentence in a Jumbled Paragraph for proper communication. • Cloze passage for grammar learning **Practical on Different forms of writing:** Persuasive, expository, narrative, descriptive forms of writing Skill Development **Picture composition & Precis Writing:** • Activity writing • Information Transfer • Experience Sharing Skill Development & Employability	3
5.	**Learning through Software**	**Practice Quick Reading through Software:** SKY Read up-Speed Up Software or SAT/CAT/IELTS exercises. Skill Development **Practice Speaking through Software:** Sanako Pronounce Skill Development	2
		Total number of Labs	**14**

Evaluation Criteria	
Components	**Maximum Marks**
Mid Viva	20
End Viva	20
TA	60
Total	**100**

Project based learning: Project based learning: The students in group of 4-5 members will be given topics on current affairs, general awareness and personality development. They would search a good Ted talk for the same, listen to it and write a persuasive brief on the topic, analyzing the talk and adding their views for the same.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc.)

1.	C.L.Bovee, J.V.Thill, M.Chaturvedi, Business Communication Today, 9th edition, Pearson Education Pvt Ltd, 2021
2.	T. S. Boswood, "Redefining the professional in International Professional Communication," in Exploring the Rhetoric of International Professional Communication, C. R. Lovitt and D. Goswami, Ed. Routledge, 2020, pp. 111-136.
3.	R.K Bansal, J.B Harrison, "Spoken English for India", Orient Longman, 2018.
4.	R. Almonte, A Practical Guide to Soft Skills: Communication, Psychology, and Ethics for Your Professional Life. Routledge, 2021.
5.	K. M. Quintanilla, S. T. Wahl, Business and Professional Communication: Keys for Workplace Excellence. Sage Publications, 2020
6.	K. Floyd, P. W, Cardon, Business and Professional Communication. McGraw-Hill Education, 2020.
7.	M A Yadugiri, "The Pronunciation of English: Principles and Practice", Viva Books Pvt. Ltd, India, 2015

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K241.1							2	3	3			
K241.2							2	3	3			
K241.3							2	3	3			
K241.4							2	3	3			
Avg							2	3	3			

English Literature (23B21HS211)

Introduction to Literature & Genres, Poems to learn figurative language, Introduction to Theories to analyze Literature as mirror of Society, Prose, Short Stories, Plays and Novel to examine their respective themes, style, linguistic and ethical aspects as reflection of the society at large.

Course Description

Course Code	**23B21HS211**	**Semester Odd**	**Semester III Session 2023-24** Month from Jul 2023 to Dec 2023
Course Name	**English Literature**		
Credits	**2**	**Contact Hours**	**2-0-0**
Faculty (Names)	**Coordinator(s)**		

	Teacher(s) (Alphabetically)	

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K251.1	explain different genres of literature and aspects of language learning through literature.	Understand Level (C2)
K251.2	apply rhetoric, figurative language and theoretical concepts to texts.	Apply Level (C3)
K251.3	analyze a literary text thematically and stylistically to examine it as a mirror of society.	Analyze Level (C4)
K251.4	examine Literature as learning interface of moral values and ethics of life and society.	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Literature & Genres	Introduction Literary Genres Literary Devices Aspects of Language Learning Communication Skills through Literature	5
2.	Poems	If: Rudyard Kipling Ode to Clothes: Pablo Neruda The Road Not Taken: Robert Frost Success is Counted Sweetest by those who Never Succeed: Emily Dickinson Goodbye Party for Miss Pushpa T.S.: Nissim Ezekiel The Highway Man: Alfred Noyes	7
3.	Introduction to Theories	Introduction to Psycho-analysis, Structuralism and Reader Response Theories Introduction to Freitag's Narrative technique	4
4.	Prose & Short Stories	Swami Vivekananda's Speech The Castaway: Rabindranath Tagore The Monkey's Paw: W.W.Jacob	6
5.	Plays	Andher Nagri Choupat Raja: Bhartendu Harishchandra Refund: Fritz Karinthy	4
6.	Novel	Brave New World: Aldous Huxley	4
		Total number of Lectures	**30**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Project and class participation)
Total	**100**

Project Based Learning: The Project will be done in two parts. A group of 4 – 5 students would be required to take up any text (speech, short story, novel, play or poem, that is not part of syllabus).

Part A: To apply the theories on the text and analyze it thematically and stylistically. Part A could be in the form of a poster presentation or research paper style.

Part B: To submit 1-2 pages report stating the aspects of language, communication skills and ethical standpoints that they have learnt from the text.	
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1	J. E. Eck, Writing with Sweet Clarity, 1st Edition, Routledge 2022. https://doi.org/10.4324/9781003167532
2	M.H. Abrams, G. Harpham, A Glossary of Literary Terms, 11th Edition, Cengage Learning, 2014.
3	F. Karinthy, Refund, e-book @ https://egyankosh.ac.in/bitstream/123456789/27478/1/Unit-4.pdf
4	R. Tagore, The Castaway: (Rabindrantath Tagore Masterpiece Collection). N. p.: CreateSpace Independent Publishing Platform, 2014.
5	W.W. Jacob, The Monkey's Paw, e-book @ https://gutenberg.org/ebooks/12122
6	A. Huxley, Brave New World (First Perennial Classics ed.), New York: HarperCollins Publishers, 1998.
7	All poems online: *https://www.poetryfoundation.org/*

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K251.1								3				
K251.2								3				
K251.3					1		2		2			
K251.4					2				2			
Avg					**2**		**2**	**3**	**2**			

Web Development- Project Based Learning (23B51CS211)

Web based Problem Formulation. Real life Scenario Study, Review of Essential topics in Web Development, Web development in design of web pages using XML and CSS, Developing dynamic web pages using Java Script, Databases and PHP, Database Connectivity using MYSQL. Technical Report Writing for Web Project.

Course Description

Subject Code	**23B51CS211**	**Semester Odd**	**Semester: III Session: 2023- 2024 Month from July-Dec 2023**	
Subject Name	**Web Development-Project Based Learning**			
Credits	**2**	**Contact Hours**	**0-0-4**	
Faculty (Names)	**Coordinator(s)**			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K261.1	explain Web programming fundamentals	Understand Level (C2)
K261.2	interpret logic building of real case studies solution using Web Designing concepts	Understand Level (C2)
K261.3	plan a Problem Statement for Real Life Application, Feasibility Study, Requirement Specification, Software Design Principles for the Problem.	Apply Level (C3)
K261.4	develop an ability to work in a project team and integrate modules developed by team members	Apply Level (C3)
K261.5	examine technical report detailing the problem statement, proposed methodology, software specification, design specifications, test plan, and implementation details.	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Fundamentals of Web Designing	Review of Essential topics in Web Development, Web development in design of web pages using XML and CSS, Developing dynamic web pages using Java Script, Databases and PHP and MYSQL Connectivity. Understand React JS for event-driven programming concepts.	6
2	Real life Case Sudies	Real life Study of Existing Web based Applications.	4
3	Web Design and Analysis using UML	Use Case Diagrams, Class Diagram, Sequence Diagram, State Diagrams, Collaboration Diagrams.	6
4	Web Implementation	Web concepts and programming using HTML, XMl, CSS, PHP, Java Script, MYSQL.	8
5	Project	Analyze and identify various Web principles for project Develop, design, implementation, plan, demonstrate.	2
6	Prepare technical report	Prepare technical report detailing the problem statement, proposed methodology, software specification, design, test plan, and implementation detail.	2
		Total number of Labs	**28**

Evaluation Criteria

Components	**Maximum Marks**
Assessment	40
Viva Voice of Project (Mid and Final)	35

End Semester Report + Presentation	15
Attendance	10
Total	**100**

Project based learning: Project is an integral part of the lab. Students form a group (of size 3), and discuss their project ideas with their faculty before finalizing their research areas. The project is done using object-oriented programming language and develops applications ranging from basic to advanced problem statements. This helps students in understanding the working of project development in companies and also broadens the spectrum for team work and procedural implementation of projects in hand to be delivered to clients as per the requirements.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	V. DeBolt, Integrated HTML and CSS A Smarter, Faster Way to Learn Wiley / Sybex, 2006.
2.	C. Williams, C. Williams Introduction to HTML and CSS, O'Reilly, 2015
3.	HTML A Beginner's Guide, Tata McGraw-Hill Education, 5th edition 2013.
4.	J. A. Ramalho, Learn Advanced HTML 4.0 with DHTML, BPB Publications, 2007
5.	S. Holzner, PHP: The Complete Reference Paperback, McGraw Hill Education (India), 2008.
6.	R. Nixon, Learning PHP, MySQL, JavaScript, CSS & HTML5, 3rd Edition Paperback, O'reilly, 2014.
7.	D. Sklar, A. Trachtenberg, PHP Cookbook: Solutions & Examples for PHP Programmers, 2014.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K261.1	2	2	2	1	1		1	1	2	3	3	3
K261.2	2	2	3	2	1		2	1	2	3	3	3
K261.3	3	3	3	3	1		2	1	2	3	3	3
K261.4	3	3	3	3	1		3	1	3	3	3	3
K261.5	3	3	3	3	1		3	1	3	3	3	3
Avg	**3**	**3**	**3**	**3**	**1**		**3**	**1**	**3**	**3**	**3**	**3**

Competitive Programming Workshop (23B51CS212)

CP1 teaches several commonly encountered techniques to solve programming interview and competitive programming questions, including usage of data structures such as set, map, stack, queue, deque, priority queue, prefix sum arrays, two pointers, sliding window, depth-first search, breadth-first search, binary search, meet-in-the-middle, etc. These platforms offer challenges and competitions for various programming languages such as C, C++, and more. Additionally, they also offer tutorials, video lectures, and other resources to help you improve your skills.

Course Description

Course Code	23B51CS212	Semester Odd	Semester III Session 2023-24 Month from Jul 2023 to Dec 2023
Course Name	Competitive Programming Workshop		
Credits	2	Contact Hours	1-0-2
Faculty (Names)	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		COGNITIVE LEVELS
K271.1	demonstrate the working of various online competitive platforms	Understand Level (C2)
K271.2	explain various data structures and algorithm design techniques with the help of examples.	Understand Level (C2)
K271.3	apply and build various algorithms and design techniques to solve the given problem.	Apply Level (C3)
K271.4	examine the algorithm by their complexity using asymptotic notation.	Analyze Level (C4)
K271.5	examine the correctness and complexity of the algorithm for a given problem.	Analyze Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Labs
1.	Competitive Platforms	Develop Code on Various Competitive Platform Leetcode, Codechef, codeforces, geeksforgeek, CodeChef, HackerRank, TopCoder, AtCoder, HackerEarth, etc	1
2.	Data Structures	Arrays, Linked Lists, Stacks, Queues,	4
3.	Algorithms	Sorting, Searching, Greedy Algorithms, Backtracking, Divide and Conquer, etc.	4
4.	Programming Concepts	Recursion, Pointers, Dynamic Memory Allocation, Bit Manipulation, etc.	3
5	Problem-Solving Techniques	Problem analysis, Test case generation, Debugging, etc.	2
		Total number of Labs	**14**

Evaluation Criteria

Components	Maximum Marks
Mid	30
End	40
Day-to-Day	30 (Quiz, Assignment, Test, Attendance)
Total	**100**

Project based learning: A group of 3-4 students will be formed. Each group will have a group leader to develop coordination among the group members. Each group will be assigned a problem related real life applications of algorithms. The group leader of each group will submit a report and then finally each member of the group will be evaluated through a viva voce.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, MIT Press, 4th Edition, 2022.
2.	S. Skiena,The Algorithm Design Manual, Springer; 2nd Edition, 2020.
3.	D. E. Knuth, The art of Computer Programming Volume 4A, Pearson Publication 2014.
4.	E. Horowitz, S. Sahni, Fundamentals of Computer Algorithms, Computer Science Press, 2008
5.	R. Sedgewick, Algorithms in C, 3rd edition. Addison Wesley, 2002.
6.	A. V. Aho, J.E. Hopcroft, and Jeffrey D. Ullman, Data Structures and Algorithms, Addison-Wesley Publishing Company, 1983.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K271.5	2	2	2	3	1		1	1	2	3	3	3
K271.5	2	2	2	2	1		1	1	2	3	3	3
K271.5	2	2	3	2	1		3	1	2	3	3	3
K271.5	3	3	3	2	1		2	1	2	3	3	3
K271.5	3	3	3	2	1		3	1	2	3	3	3
Avg	**3**	**3**	**3**	**3**	**1**		**2**	**1**	**2**	**3**	**3**	**3**

Fourth Semester

Open Source Programming (24B51CS241)

Course Description

Course Code	**24B51CS241**	**Semester: Even**	**Semester** IV **Session** 2023-24 **Month from** Jan-May 2024
Course Name	**Open Source Programming**		
Credits	**3**	**Contact Hours**	3-0-0
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K211.1	define open source software (OSS) and relate the benefits of various OSS models.	Remembering (C1)
K211.2	understand the concept of Python for open source software development	Understanding (C2)

K211.3	develop applications and database using the open source Python language.		Applying (C3)
K211.4	analyze data charts or graphs using open source tools.		Analyzing (C4)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Introduction to open source	What is open source software, what is proprietary software, open source governance models, advantages of OSS, contributing to OSS projects.	3
2.	Introduction to Python	Python programming, Python as a language, installing Python and writing a program, expression, Python programming continued: conditional statements, functions, strings.	9
3.	Data structure in Python	Array, matrix, the power of lists, list methods, accessing an item from a list, adding an item to a list, dictionary keys and values, dictionary methods, tuples.	9
4.	Python libraries	Introduction to Python libraries: NumPy, case study for the implementation of all libraries.	4
5.	Data storage and retrieval	File processing, reading, writing and appending to files, connectivity of Python with SQL database, querying and retrieving data.	7
6.	Data Visualization	Introduction to Matplotlib, introduction to data visualization, types of charts, steps for creating data visualization.	7
7.	Case Studies: Popular open source software	Study popular open source software, their architecture, development time-line, challenges.	3
Total Number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: The students will work in a group of 3/4 members. In the mini-project, students will be able to develop applications using Python and its Libraries. Further they will be able to explore various open source tools and techniques used in different domains like data-science, machine learning and AI etc.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	**Brown A., and Wilson G.,** The Architecture of Open Source Applications: Elegance, Evolution, and a Few Fearless Hacks. Lulu. Com, Vol. 1., 2011.
2.	**Fogel K.,** Producing Open Source Software: How to Run a Successful Free Software Project, O'Reilly Media, 2009.

Reference Books

3.	**Barry P.**, Head First Python: A Brain-Friendly Guide, O'Reilly Media, Inc., 2016.

4.	**Roffey C.**., Coding Club Python: Next Steps Level 2, Cambridge University Press, 2013.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PSO-CS	PSO-IT	PSO-CP
K211.1	3	3	3	2	1		2	1	2	3	3	3
K211.2	3	3	3	2	1		2	1	2	3	3	3
K211.3	2	2	2	2	1		1	1	2	3	3	3
K211.4	3	3	3	2	1		2	1	2	3	3	3
Avg	**2.75**	**2.75**	**2.75**	**2**	**1**		**1.75**	**1**	**2**	**3**	**3**	**3**

Open source Programming Lab (24B55CS242)

Course Description

Course Code	**24B55CS242**	**Semester: Even**	**Semester** IV **Session** 2023-24 **Month from** Jan-May 2024	
Course Name	**Open Source Programming Lab**			
Credits	**1**	**Contact Hours**	0-0-2	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:			**COGNITIVE LEVELS**
K236.1	define open source software (OSS) and relate the benefits of various OSS models.		Remembering (C1)
K236.2	understand the concept of Python for open source software development		Understanding (C2)
K236.3	develop applications and database using the open source Python language.		Applying (C3)
K236.4	analyze data charts or graphs using open source tools.		Analyzing (C4)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Introduction to Open Source	Hands on existing open source software.	1

2.	Introduction to Python	Python programming, Python as a language, installing Python and writing a program, Python interpreter, identifiers and keywords, literals, strings, operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator. Ternary operator, Bit wise operator, Increment or Decrement operator), Expression, conditional statements, functions, strings.	3
3.	Data structure in Python	Programming practice on array, matrix, the power of lists, list methods, accessing an item from a list, adding an item to a list, dictionary keys and values, dictionary methods, tuples.	3
4.	Python libraries	Working on Python libraries: NumPy, case study for the implementation of all libraries	2
5.	Data Storage & Retrieval	File processing, reading, writing, and appending to files, connectivity of Python with SQL database, querying and retrieving data.	2
6.	Data Visualization	Program using Matplotlib, data visualization.	2
7.	Case Studies: Popular Open Source Softwares	Case study on popular open source softwares, their architecture, development time-line, challenges.	1
Total Number of Labs			**14**

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60
Total	**100**

Project based learning: The students will work in a group of 3/4 members. In the mini-project, students will be able to develop applications using Python and its Libraries. Further they will be able to explore various open source tools and techniques used in different domains like data-science, machine learning and AI etc.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	**Brown A., Wilson G.**, The Architecture of Open Source Applications: Elegance, Evolution, and a Few Fearless Hacks, Lulu. Com, Vol. 1., 2011.
2.	**Fogel K.**, Producing Open Source Software: How to Run a Successful Free Software Project, O'Reilly Media, 2009.
3.	**Barry, P.**, Head First Python: A Brain-Friendly Guide, O'Reilly Media, Inc., 2016.
4.	**Roffey, C.**, Coding Club Python: Next Steps Level 2. Cambridge University Press, 2013.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PSO-CS	PSO-IT	PSO-CP

K236.1	3	3	3	2	1		2	1	2	3	3	3
K236.2	3	3	3	2	1		2	1	2	3	3	3
K236.3	2	2	2	2	1		1	1	2	3	3	3
K236.4	3	3	3	2	1		2	1	2	3	3	3
Avg	**2.75**	**2.75**	**2.75**	**2**	**1**		**1.75**	**1**	**2**	**3**	**3**	**3**

Data Base Management System (24B51CS243)

Course Description

Course Code	**24B51CS243**	**Semester: Even**	**Semester IV** **Session** 2023-24 **Month from** Jan-May2024
Course Name	**Data Base Management System**		
Credits	**3**	**Contact Hours**	3-0-0
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K212.1	explain the basic concepts of database systems and programming languages.	Understanding (C2)
K212.2	explain data models, functional dependencies, relational algebra and concurrency.	Understanding (C2)
K212.3	apply programming languages on various data models.	Applying (C3)
K212.4	apply various database techniques for transaction and recovery management.	Applying (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	**Introduction to Databases**	Introduction to databases, physical level of data storage; Structure of relational databases.	4
2.	**Data Models and database design**	Database design and ER model, entity type, attributes, relation types, notations, constraints, extended ER features, relational model	6
3.	**Structured Query Language (SQL)**	Data definition and manipulation, SQL create, insert, update, delete, select statements, order by, aggregate function, join and nested queries	6
4.	**FDs and Normalization**	Anomalies, data dependencies, closures, 1NF, 2NF, 3NF, BCNF, building normalized databases	5
5.	**Relational Algebra**	Introduction, selection and projection, set operations, renaming, joins, division, operators, grouping	5

6.	**Procedural Language**	PL/SQL: stored procedures, functions, cursors, triggers	6
7.	**Transaction Management**	Transactions, concurrency, recovery, security.	5
8.	**Concurrency & Recovery**	Introduction to databases and transactions, ACID properties, serializability and concurrency control, lock based concurrency control (2PL, Deadlocks), time stamping methods, database recovery management.	5
Total Number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End-Term	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: Each student in a group of 2-3 will develop a project based on different real-world problems pertaining to database related Technologies. Project development will enhance the knowledge and employability of the students in IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	**Henry F K., Abraham S., Sudurshan, S.,** Database System Concepts, McGraw-Hill, 5th Edition, 2006.
2.	**Elmasri R., Navathe, S.B.,** Fundamentals of Database Systems, Pearson Education, 4th Edition, 2006.
3.	**Ramakrishnan R., Gehrke J.,** Database Management Systems, Mcgraw-Hill, Addison-Wesley, 3rd Edition, 2006.
4.	**Connolly T., Begg C.,** Database Systems-A Practical Approach to Design, Implementation and Management, Addison-Wesley, 3rd Edition, 2002.
5.	**Date C.J. ,** Database Design and Relational Theory: Normal Forms and All That Jazz, 2012.
6.	**Chopra R.,** Database Management System (DBMS): A Practical Approach, 5th Edition, 2016.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K212.1	3	3	3	2	1		2	1	2	3	3	3
K212.2	3	3	3	2	1		2	1	2	3	3	3
K212.3	2	2	2	2	1		1	1	2	3	3	3
K212.4	3	3	3	2	1		2	1	2	3	3	3
Avg	**2.75**	**2.75**	**2.75**	**2.00**	**1.00**		**1.75**	**1.00**	**2.00**	**3.00**	**3.00**	**3.00**

Data Base Management System-Lab (24B55CS244)

Course Description

Course Code	**24B55CS244**	**Semester: Even**	**Semester IV** **Session** 2023-24 **Month from** Jan-May 2024	
Course Name	**Data Base Management System-Lab**			
Credits	**1**	**Contact Hours**	0-0-2	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K237.1	demonstrate the basic commands of programming languages.	Understanding (C2)
K237.2	construct code in PL/SQL programming for simple problems.	Applying (C3)
K237.3	develop and implement a database schema for a given problem-domain.	Applying (C3)
K237.4	compare data base management techniques by developing a project.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Introduction to MySQL commands.	MySQL Create, Insert, Update, Delete and Select Statements.	6
2.	SQL	Simple queries, sorting results (ORDER BY Clause), SQL aggregate functions, grouping results (GROUP BY Clause), subqueries, ANY and ALL, multi-table queries, EXISTS and NOT EXISTS, combining result tables (UNION, INTERSECT, EXCEPT), database updates	4
3.	Procedural Language	1. Write PL/SQL program for storing data using procedures. 2. Write PL/SQL program for storing data using stored functions. 3. Write PL/SQL program for storing data using cursors and Triggers.	4
Total Number of Labs			**14**

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20

Day-to-Day	60
Total	**100**

Project based learning: Each student in a group of 2-3 will develop a project based on different real-world problems pertaining to database related Technologies. Project development will enhance the knowledge and employability of the students in IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	**Korth H.F. , Silberschatz A., Sudarshan S.** Database System Concepts, McGraw-Hill, 7th Edition, 2019.
2.	**Elmasri R., Navathe S.B.**, Fundamentals of Database Systems, Pearson Education, 5th Edition, 2015.

Reference Books

3.	**Ramakrishnan G.,** Database Management Systems, Mcgraw-Hill, Addison-Wesley, 3rd Edition, 2006.
4.	**Connolly T., Begg C.,** Database Systems - A Practical Approach to Design, Implementation and Management, Addison-Wesley, 6rd Edition, 2015.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K237.1	3	3	3	2	1		2	1	2	3	3	3
K237.2	3	3	3	2	1		2	1	2	3	3	3
K237.3	2	2	2	2	1		1	1	2	3	3	3
K237.4	3	3	3	2	1		2	1	2	3	3	3
Avg	2.75	2.75	2.75	2.00	1.00		1.75	1.00	2.00	3.00	3.00	3.00

Design and Analysis of Algorithms (24B21MA211)
Course Description

Course Code	**24B21MA211**	**Semester: Even**	**Semester IV Session 2023-24** **Month from** Jan-May 2024	
Course Name	**Design and Analysis of Algorithms**			
Credits	**3**	**Contact Hours**	3-0-0	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K213.1	explain different sorting and searching methods.	Understanding (C2)

K213.2	identify the complexity of different algorithms using asymptotic analysis.		Applying (C3)
K213.3	apply algorithmic principles for solving computational problems.		Applying (C3)
K213.4	analyze an efficient solution to a given problem using appropriate data structure and algorithm design techniques.		Analyzing (C4)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Introduction	Introduction to problem solving approach; asymptotic analysis: growth of functions and solving recurrences; notations- big O, big omega, big theta, little O; empirical analysis of sorting and searching algorithms – merge sort, quick sort, heap sort, radix sort, count sort, linear search, binary search and median search.	6
2.	Divide and Conquer Methods	Fundamentals of divide and conquer (D&C) approach using binary search, quick sort and merge sort; Strassen's matrix multiplication and closest pair, etc.	6
3.	Greedy Algorithms	Introduction to greedy based solution approach, minimum spanning trees (Prim's and Kruskal algorithms), shortest path using Dijkstra's algorithm, fractional and 0/1 Knapsack; coinage problem, bin packing; job scheduling–shortest job first, Shortest remaining job first, etc., graph coloring; and text compression using Huffman coding and Shannon-Fanon coding, etc.	7
4.	Backtracking Algorithms	Review of backtracking based solution approach using N queen, and rat in a maze, M-coloring problem; Hamiltonian cycle detection, travelling salesman problem, network flow.	6
5.	Dynamic Programming	Fundamentals of dynamic programming based solution approach, 0/1 Knapsack, shortest path using Floyd Warshall, coinage problem; matrix chain multiplication, longest common subsequence, longest increasing sequence, string editing.	7
6.	String Algorithms	Naive string matching, finite automata matcher, Rabin Karp matching algorithm, Knuth Morris Pratt, solving string problems using string data structures like tries, suffix tree and suffix array.	7
7.	Tractable and Non- Tractable Problems	Efficiency and tractability, P, NP, NP-complete, NP-hard problems.	3
Total Number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: Each student in a group of 3-4 will have to develop a mini project based on data structures algorithms. The students can opt any real-world application where these algorithms can be applied. The students have to implement the mini project using C/C++/Java language. Project development and its presentation will enhance coding skills, knowledge and employability of the students in IT sector.	
Recommended Reading material:	
1.	**Cormen T.H., Leiserson C.E.,.Rivest R.L., and Stein C.,** Introduction to Algorithms, MIT Press, 3rd Ed, 2009.
2.	**Skiena S.,** The Algorithm Design Manual, Springer; 2nd Ed, 2008.
3.	**Knuth D.,** The Art of Computer Programming Volume 1, Fundamental Algorithms, Addison-Wesley Professional, 3rd Ed,1997.
4.	**Horowitz, E., Sahni, S. ,** Fundamentals of Computer Algorithms, Computer Science Press, 2008.
5.	**Sedgewick R.,** Algorithms in C, Addison Wesley, 3rd Ed, 2002.
6.	**Alfred V. A, Hopcroft J.E. and Ullman J. D.,** Data Structures and Algorithms, Addison-Wesley Series in Computer Science and Information Processing, 1983.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K213.1	3	3	3	2	1		2	1	2	3	3	3
K213.2	3	3	3	2	1		2	1	2	3	3	3
K213.3	2	2	2	2	1		1	1	2	3	3	3
K213.4	3	3	3	2	1		2	1	2	3	3	3
Avg	**2.75**	**2.75**	**2.75**	**2**	**1**		**1.75**	**1**	**2**	**3**	**3**	**3**

Design and Analysis of Algorithms Lab (24B25MA211)

Course Description

Course Code	**24B25MA211**	**Semester: Even**	**Semester IV Session 2023-24** **Month from** Jan-May 2024	
Course Name	**Design and Analysis of Algorithms Lab**			
Credits	**1**	**Contact Hours**	0-0-2	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			
COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:				**COGNITIVE LEVELS**
K238.1	understand various data structures and algorithm design techniques with the help of examples.			Understanding (C2)
K238.2	develop an efficient solution to a given problem using appropriate data structure and algorithm design technique.			Applying (C3)

K238.3	apply and build various algorithms and design techniques to solve given problems.		Applying (C3)
K238.4	evaluate the correctness and complexity of the algorithm for a given problem.		Analyzing (C4)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Introduction to MatLab	Basic operations in MatLab, saving workspaces and files, operations on arrays, matrices, strings and graph objects, native data structures in MatLab, using inbuilt functions and toolboxes, if conditional statements, for and while loops, saving functions,	1
2.	Analysis of algorithms, searching and sorting based problems	Introduction to problem solving approach; asymptotic analysis; solving recurrences; empirical analysis of sorting and searching algorithms – merge sort, Quick sort, heap sort, radix sort, count sort, binary search, and median search,	2
3.	Divide and Conquer Methods	Problems based on divide and conquer (D&C) approach such as binary search, quick sort and merge sort and closest pair, etc.	1
4.	Greedy Algorithms	Introduction to greedy based solution approach, minimum spanning trees (Prim's and Kruskal algorithms), shortest path using Dijkstra's algorithm, fractional and 0/1 Knapsack, coinage problem, bin packing, job scheduling – shortest job first, shortest remaining job first, etc., graph coloring, and text compression using Hamming coding and Shannon-Fano coding, etc.	2
5.	Backtracking Algorithms	Review of backtracking based solution approach using N queen, and rat in a maze, M-coloring problem, Hamiltonian cycle detection, travelling salesman problem, network flow.	2
6.	Dynamic Programming	Fundamentals of Dynamic programming based solution approach, 0/1 Knapsack, shortest path using Floyd Warshall, Coinage problem, matrix chain multiplication, longest common subsequence, longest increasing sequence, string editing.	2
7.	String Algorithms	Naïve string matching, finite automata matcher, Rabin Karp matching algorithm, Knuth Morris Pratt, Tries, suffix tree and suffix array.	2
8.	Problem Spaces and Problem solving by search	Problem Spaces: states, goals and operators, factored representation (factoring state into variables) uninformed search (BFS, DFS, DFS with iterative deepening), heuristics and informed search (hill-climbing, generic best-first, A*).	2
Total Number of Labs			**14**
Evaluation Criteria Components		**Maximum Marks**	

Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60
Total	**100**

Project based learning: Students in a group of 4-5 will be designing an efficient solution to a given problem / case-studies using appropriate data structure and algorithm design technique studies in the course. The students have to implement the mini project using MatLab/C/C++ language. Project development and its presentation will enhance coding skills, knowledge and employability of the students in IT sector.

Recommended Reading material:

1.	**Cormen T.H., Leiserson C.E.,.Rivest R.L., and Stein C.,** Introduction to Algorithms, MIT Press, 3rd Ed, 2009.
2.	**Skiena S.,** The Algorithm Design Manual, Springer; 2nd Ed, 2008.
3.	**Knuth D.,** The Art of Computer Programming Volume 1, Fundamental Algorithms, Addison-Wesley Professional, 3rd Ed,1997.
4.	**Horowitz, E., Sahni, S. ,** Fundamentals of Computer Algorithms, Computer Science Press, 2008.
5.	**Sedgewick R.,** Algorithms in C, Addison Wesley, 3rd Ed, 2002.
6.	**Alfred V. A, Hopcroft J.E. and Ullman J. D.,** Data Structures and Algorithms, Addison-Wesley Series in Computer Science and Information Processing, 1983.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K238.1	3	3	3	2	1		2	1	2	3	3	3
K238.2	3	3	3	2	2		1	1	1	3	3	3
K238.3	3	2	2	2	1		1	1	2	3	3	3
K238.4	3	3	3	2	1		2	1	2	3	3	3
Avg	**3**	**2.75**	**2.75**	**2**	**1.25**		**1.5**	**1**	**1.75**	**3**	**3**	**3**

Linear Algebra (24B21MA212)

Course Descriptions

Course Code	**24B21MA212**	**Semester: Even**	**Semester** IV **Session** 2023 -2024 **Month from** Jan -May 2024	
Course Name	Linear Algebra			
Credits	**4**	**Contact Hours**	**3-1-0**	
Faculty (Names)	**Coordinator(s)**			
	Teacher(s) (Alphabetically)			
COURSE OUTCOMES: After pursuing the above mentioned course, the students will be able to:				**COGNITIVE LEVELS**

K226.1	recall basic concepts of algebraic structures and system of linear equations.		Remembering (C1)
K226.2	explain vector space, linear transformation, inner product space and eigenvalue problems.		Understanding (C2)
K226.3	apply the concept of orthogonality and linear transformations in solving the related problems.		Applying (C3)
K226.4	examine the problems related to system of linear equations, diagonalizability of matrices and Gram-Schmidt orthogonalization.		Analyzing (C4)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction of modern algebra	Definitions of group, subgroup, cyclic group, normal subgroup, ring, integral domain, field and its examples with simple properties.	8
2.	Vector Spaces	Vector Space, vector subspace, linear dependence and independence, Span of a set, Dimension of a vector space, Direct sum and complement.	7
3.	Linear Transformation	Linear transformation and its algebra, its matrix representation, homomorphism, isomorphism, rank and null subspace, rank-nullity theorem, Solution of a system of linear equations, Determinant, Change of basis, Inverse of a linear transformation.	10
4.	Eigenvalues and Eigenvectors	Eigenvalues and Eigenvectors, Modal matrix and diagonalization, Similarity transformation, Eigen systems of real symmetric, orthogonal, Hermitian and unitary matrices.	9
5.	Inner Product and Metric	Inner product space, Metric and normed spaces. Orthonormal basis, Orthogonal Subspaces, Gram-Schmidt orthogonalization.	8
		Total Number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project Based Learning: Each student in a group of 4-5 students will apply the concepts of eigenvalues and eigenvectors, Gram-Schmidt orthogonalization process in solving various related problems.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**Hoffman K., Kunze R.** , Linear Algebra, Prentice Hall of India, Fourth Edition, 2005.
2.	**Strang G.**, Linear Algebra and its Applications, 3rd Ed., 2008.
3.	**Noble B., Daniel J.**, Applied Linear Algebra, Prentice Hall of India, 2000.
4.	**Lipshutz S., Lipsom M. ,** Linear Algebra, 6th Edition, Schaum Series, 2017.
5.	**Krishnamurthy V., Mainra V. P., and Arora J. L.** , An Introduction to Linear Algebra, Affilated East-West, 1976.

CO-PO and CO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K226.1	2	2	1						2	1	1	1
K226.2	2	3	2						2	2	2	2
K226.3	2	2	2						2	2	1	2
K226.4	3	3	2						2	1	1	1
Avg	**2.25**	**2.5**	**1.75**						**2**	**1.5**	**1.25**	**1.5**

Sustainable Development (24B21HS211)

Course Description

Course Code	**24B21HS211**	**Semester-Even**	**Semester IV Session** 2023-24 **Month from** Jan - May 2024
Course Name	**Sustainable Development**		
Credits	2	**Contact Hours**	2-0-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K256.1	understand the fundamental theories, principles, and historical history of sustainable development.	Understanding (C2)
K256.2	analysis of factors that support to achieve sustainability and resilience in an individual level and in a community	Analysing (C4)
K256.3	understand the possible course of action for SD strategically (efficiency, sufficiency)	Understanding (C2)
K256.4	analyse the conflicts that arise from the SD notion both nationally and internationally.	Analysing (C4)
K256.5	understand the issues surrounding sustainable development that affect academic institutions, businesses and communities.	Understanding (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Sustainable Development	Overview of sustainable development (SD) including its significance, necessity, effects, and ramifications, definition, development of SD perspectives (MDGs AND SDGs) across time, current discussions, 1987 Brundtland Commission and its results, subsequent UN summits (such as the Rio summit) and their results.	6
2.	Dimensions to Sustainable Development	Society, environment, culture, and economy, contemporary issues: natural, political, and socioeconomic imbalances, international, regional, national, and local sustainable development programmes and policies, demands of the current and	4

		future generations: political, economic, and environmental.	
3.	Evaluation, Administration and Reporting Tools for Sustainability	Tools for SD, sustainability measures, including criteria and indicators, the value of both quantitative and qualitative evaluations of sustainability, analytical frameworks in sustainability research, existing measures and constraints, measures for charting and assessing sustainable development use of the metrics in practical situations.	6
4.	Sustainable Development, Energy, Biodiversity, and Climate Change	Climate Change: A threat to Sustainable Development Adaptation to Current and Future Climate Regimes; Agricultural Failure; The Greenhouse Effect; Technology and Lifestyle Changes as Solutions, Climate Change Mitigation, Political and Economic Tools	6
5.	Critical Views on Sustainable Development: The Implications of Resource Management for Sustainable Development	Conflicts arising from the SD idea at the national and international levels, the difficulties SD presents for academic institutions, businesses, and communities, their accountability and possibilities for action, the influence of policies and governance, Market dynamics, regulations, a fresh outlook on sustainability, and sustainable business practises • Sustainable goods and services • Corporate governance • Social responsibility • Encouraging Sustainable Urban Development	6
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	30
End Semester Examination	40
TA	30 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: A group of 4 to 5 students will be formed. Each group will have a group leader to develop coordination among the group members. Each group will be assigned a topic related to Future Perspectives: Developing Sustainable Development. The group leader of each group will submit a report of 6-7 pages and then finally each member of the group will be evaluated through a viva voce.

Recommended Reading material:

1.	**Elliott J.**, An Introduction to Sustainable Development, Routledge, London, 4th Ed , 2012.
2.	**Franco I.B. and Tracey J.**, Community Capacity-Building for Sustainable Development: Effectively Striving Towards Achieving Local Community Sustainability Targets, International Journal of Sustainability in Higher Education, Vol. 20 No. 4, pp. 691-725, 2019.
3.	**Rogers P. P., Jalal K.F. , and Boyd, J.A.,** "An Introduction to Sustainable Development, Earthscan publisher, 2012.
4.	**Nhamo G.,Mjimba V.,** Sustainable Development Goals and Institutions of Higher Education. Springer, 2020.
5.	**Bell S. , Morse S.,** Sustainability indicators: measuring the immeasurable, Routledge, 2012.

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PEO 1	PEO 2
K256.1					2	2					
K256.2					2	3					
K256.3		1	1	1	3	3					
K256.4			1	1	3	3					
K256.5					2	2					
Avg.		1	1	1	2.4	2.6					

Open Source Project Based Learning (24B55CS245)
Course Description

Subject Code	**24B21MA212**	**Semester: Even**	**Semester** IV **Session** 2023 -2024 **Month from** Jan -May 2024
Subject Name	Open Source Project Based Learning		
Credits	**3**	**Contact Hours**	**0-0-6**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s)		

COURSE OUTCOMES: After the completion of the course, students will be able to		**COGNITIVE LEVELS**
K266.1	compare and contrast their project with existing literature in the area and prepare a project proposal.	Understanding (C2)
K266.2	demonstrate ability to function in task oriented team, divide role responsibilities to build a project on open data and understand professional and ethical responsibility.	Understanding (C2)
K266.3	identify various open data frameworks, and apply RESTful APIs, Python libraries for project implementation.	Applying (C3)
K266.4	analyze and prepare technical report.	Analyzing (C4)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Labs**
1.	Literature review	Literature review to compare and contrast their project with existing work in the area and prepare a project	12

		proposal to be delivered to their peers and faculty members.	
2.	Role Mapping	Develop an ability to function in task oriented team, divide role responsibilities to build a project on open data.	1
3.	Coordination	Understand professional and ethical responsibility & acquire ability to communicate effectively amongst team members, peers & evaluators.	2
4.	Submit Project Developmen t Timeline	Analyze and identify various open data frameworks, RESTful APIs, Python libraries for project implementation; plan & submit project development timeline.	12
5.	Presentation	Appraise by giving milestone presentations to their peers and faculty about their current progress.	3
6.	Prepare technical report	Prepare technical report detailing the problem statement, proposed methodology, software specification, design, test plan, and implementation details.	12
		Total number of Labs	42

Project based learning: Project is an integral part of the lab. Students form a group (of size 3-4) and discuss their project ideas with their faculty before finalising their research areas. The project is done using Open-source software(s), which are easily available with applications ranging from development to research-based projects or mix of both. This helps students in understanding the working of project development in companies and also broadens the spectrum for team work and procedural implementation of projects in hand to be delivered to clients as per the requirements.

Evaluation Criteria

Components	**Maximum Marks**
Monthly Assessment 1, 2 & 3	30
Viva Voce at the end of semester	30
End of semester Report & Presentation	25
Day to day/ Attendance	15
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	**Brown, A. and Wilson, G. ,** The Architecture of Open Source Applications: Elegance, Evolution, and a Few Fearless Hacks, Lulu. Com, Vol. 1., 2011.
2.	**Fogel K.,** Producing Open Source Software: How to Run a Successful Free Software Project, O'Reilly Media, 2009.
3.	**Barry P.**, Head First Python: A Brain-Friendly Guide, O'Reilly Media, Inc., 2016.

4.	**Roffey C.,** Coding Club Python: Next Steps Level 2, Cambridge University Press, 2013.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
K266.1	3	3	3	2	1		2	1	2	3	3	3
K266.2	2	2	2	2	1		1	1	2	3	3	3
K266.3	3	3	3	2	1		2	1	2	3	3	3
K266.4	3	3	3	2	1		2	1	2	3	3	3
Avg	2.75	2.75	2.75	2	1		1.75	1	2	3	3	3

Fifth Semester

Artificial Intelligence and Machine Learning (24B51CS351)

Course Description

Course Code	**24B51CS351**	**Semester Odd**	**Semester V Session 2024-25 Month Jul to Dec 2024**
Course Name	**Artificial Intelligence and Machine Learning**		
Credits	**3**	**Contact Hours**	**3-0-0**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K301.1	explain the concepts related to problem solving agents and various uninformed search strategies.	Understanding (C2)
K301.2	utilize probability and first order logic to solve queries.	Applying (C3)
K301.3	apply the clustering and classification techniques for real-world problems.	Applying (C3)
K301.4	demonstrate the different techniques of regressions and dimension reduction.	Analyzing (C4)

Module No.	Title of the Module	List of Experiments	No. of Lectures

1	**Introduction to AI**	Intelligent Agents; Problem solving by Searching; Informed and Uninformed searches; Constraint Satisfaction Problem; Game Trees.	8
2	**Knowledge Representation**	Propositional Logic, First order Logic, Syntax and Semantics), Inference in FOPL**.**	6
3	**Uncertainty in AI**	Probabilistic reasoning; Bayesian rule, Bayesian network, Maximum likelihood estimation	8
4	**Machine learning**	Supervised; Unsupervised and Semi- Supervised Learning, Decision tree; K- Nearest Neighbor; SVM, K-Means and Hierarchical clustering , Ensemble Learning.	12
5	**Dimension Reduction & Regression**	Normalizing data; feature selection; filtering techniques, PCA, SVD, Linear Regression, Multiple Regression	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance, Assignment/Quiz, PBL, etc.)
Total	**100**

Project Based Learning: Each student in a group of 2-4 will choose to design games or solve any real-world problem such as such as disease prediction, stock market prediction etc. problems to apply AI and ML techniques. It helps the students in enhancing their understanding and skills towards artificial intelligence and machine learning knowledge leading towards employability.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books:

1.	**David l. Poole & Alan k. Mackworthd**, Artificial Intelligence: foundations of computational agents, Cambridge University Press, 2017.
2.	**Deepak Khemani,** A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013.

Reference Books

1.	**Stuart Russel and Peter Norvig** , Artificial Intelligence – A modern approach , PHI, 2008.
2.	**Christopher Bishop**, Pattern Recognition and Machine Learning, 2006.
3.	**Tom Mitchell**, Machine Learning, McGraw-Hills, 1997.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K301.1	2	1	2	1			2	2	1	1
K301.2	2	1	1	1			1	2	1	1
K301.3	2	1	2	1			2	2	2	2
K301.4	2	1	2	1			2	2	1	1
Avg	**2.00**	**1.00**	**1.75**	**1.00**			**1.75**	**2.00**	**1.25**	**1.25**

Artificial Intelligence and Machine Learning Lab (24B55CS352)

Course Description

Course Code	**24B55CS352**	**Semester Odd**	**Semester V Session 2024-25 Month Jul to Dec 2024**
Course Name	Artificial Intelligence and Machine Learning Lab		
Credits	**1**	**Contact Hours**	**0-0-2**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K331.1	explain the concepts related to problem solving agents and various uninformed search strategies.	Understanding (C2)
K331.2	implement the clustering and classification techniques.	Applying (C3)
K331.3	utilize AI/ML tools for data feature selection, filtering, training and testing.	Applying (C3)
K331.4	examine the different techniques of regressions.	Analyzing (C4)

Module No.	**Title of the Module**	**List of Experiments**	**No. of Lab hours**
1	**Introduction to Programming in Python**	Familiarize the following concepts of Python programming language like Arrays, Lists, functions, Tuples, Dictionary, Sets, Objects and classes	2
2	**Problem solving**	Problem solving agents, Uninformed search strategies (BFS, UCS, DFS, DLS, IDS) Informed Search and Exploration (BFS, A*, IDA*, SMA*, IDA*)	2
3	**KNN**	Implement the KNN (K Nearest Neighbours) algorithm in python. Your program should have different functions as follows:	2

		1. Handle Data: Open the dataset from CSV and split into test/train (datasets). A ratio of 67/33 for train/test is a standard ratio used for splitting data. 2. Similarity: Calculate the distance between two data instances. The Euclidean distance is used for calculating the difference. It is defined as the square root of the sum of the squared differences between the two arrays of numbers. Only first 4 attributes are used for calculating the distance. 3. Neighbours: Locate k most similar data instances. 4. Response: Generate a response from a set of data instances. It is a function for getting the majority voted response from a number of neighbors. It devises a predicted response based on those neighbors. 5. Accuracy: Summarize the accuracy of predictions. An easy way to evaluate the accuracy of the model is to calculate a ratio of the total correct predictions out of all predictions made, called the classification accuracy. 6. Main: Take split = 0.67, k=3.	
4	**Weka Toolkit**	1. Apply the KNN algorithm in Weka tool on the iris dataset. Compare the results of your implemented algorithm with algorithm of Weka tool. 2. Implement the linear Regression. The data will be taken as input from the file. Select the appropriate dataset from the website "https://archive.ics.uci.edu/ml/index.php". Justify the reason why the dataset has been selected. b) Apply the Linear regression in Weka tool on the same dataset. Compare the results of your implemented algorithm with algorithm of Weka tool.	3

5	**Clustering**	Remove the label column of the Parkinson_dataset.csv dataset and implement the following: a) Perform K-Means clustering and Hierarchical clustering. b) Use Manhattan distance c) Use Average merging Strategy in Hierarchical clustering. d) Use three different K values in K-Mean clustering. e) Validate using RMSE and compare both the techniques.	3
6	**Logistic regression and SVM**	Divide the Parkinson_dataset.csv dataset in training and testing dataset randomly and implement the following: a. Classify the disease using Logistic regression and SVM b. Find out the accuracy of classification Model. c. Perform 5-fold cross- validation. d. Compare the result of both techniques using matplotlib.	2
		Total number of Labs	14

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60 (Quiz, Assignments, PBL)
Total	**100**

Project Based Learning: Each student in a group of 2-4 will choose some real-world problems such as congestion control, network traffic analyser etc. for development and analysis. By applying the different network protocol layer concepts and with the help of simulators it helps the students in enhancing their understanding and skills towards networking and communication issues leading towards employability.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	S. Russell and P. Norvig, "Artificial Intelligence – A Modern Approach," PHI, 2017.
2.	D. L. Poole and A. K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents," Cambridge University Press, 2017.

References Books

3.	M. Lutz, Learning Python: Powerful Object-Oriented Programming, O'Reilly Media, 2013.

4.	S. Marsland, Machine Learning: An Algorithmic Perspective, CRC Press, 2015.
5.	R. Duda, P. Hart, and D. Stork, Pattern Classification, John Wiley & Sons, 2012

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K331.1	3	3	3	2	2	1	2		2	3
K331.2	3	3	3	2	2	1	2		2	3
K331.3	3	3	3	3	2	2	2		2	3
K331.4	3	3	2	2	2	1	2		2	3
Avg	**3.00**	**3 .00**	**2.75**	**2.25**	**2 .00**	**1.25**	**2.00**		**2.00**	**3.00**

Distributed and Parallel Computing (24B51CS353)

Course Description

Subject Code	**24B51CS353**	**Semester Odd**	**Semester V Session 2024-25 Month Jul to Dec 2024**
Subject Name	**Distributed and Parallel Computing**		
Credits	**3**	**Contact Hours**	**3-0-0**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K302.1	understand Distributed, Parallel and Cloud Computing fundamentals, their characteristics, architectures and performance measures.	Understanding (C2)
K302.2	identify and solve various synchronization related issues in distributed systems, like, clock synchronization, Distributed Mutual exclusion and deadlock handling.	Applying (C3)
K302.3	identify and solve problems related to parallel algorithms, vector processing and superscalar processing.	Applying (C3)
K302.4	analyze agreement protocols, fault tolerance issues and parallel processing algorithms in distributed and parallel computing environments.	Analyzing (C4)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures
1.	**Review of principles, concepts foundation to Distributed Systems.**	Review of Operating Systems principles, Introduction to Distributed Systems.	3
2.	**Synchronization mechanisms**	Resource models, Clock synchronization, Inherent limitations of distributed operating systems. Event ordering. Timestamps. Global state collection mechanisms. Termination Detection, Bully Algorithm. Ring Algorithm.	8
3.	**Mutual Exclusion and Deadlock handling**	Distributed mutual exclusion, Token and non-token based algorithms. Deadlocks handling in Distributed Systems. Comparative performance analysis.	8
4.	**Agreement Protocols**	System Model, Classification, Byzantine Problems and solutions.	2
5.	**Fault tolerance and related Issues**	Fault Tolerance, Reliability and group communications in Distributed Systems.	5
6.	**Introduction to Parallel Computing**	Need of High-Performance Computing, Serial and Parallel Computing, Parallel Architectures, Performance Measures	6
7.	**Pipelining and Processing**	Pipelining, Pipeline performance, Vector processing, superscalar processing, types of pipeline, Hazards, Scheduling techniques.	8
8.	**Introduction to Cloud Computing.**	Introduction to Cloud Computing, Challenges, Cloud Computing architectures, Virtualization in Cloud Computing, Building applications and Infrastructures in the cloud.	2
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance, Quiz, Assignment, PBL, etc)
Total	**100**

Project-Based Learning: A group of a maximum of 2 students is to be formed. Each group shall choose a Distributed Systems, Parallel systems and/or Cloud based project. The project

shall be designed and/or modeled either based on Distributed Systems algorithms, Parallel Algorithms and/or using any Cloud Platform, and/or using and distributed/parallel simulation tools. The project shall function and run as per the objective of the project. Live demonstration of the project shall be shown during their presentation. The project evaluation shall be done based on the quality, innovation, relevance, applicability, tools used and creativity involved.	
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
Text Books	
1	M. Van Steen and A.S. Tanenbaum, Distributed Systems, 3rd ed., distributed-systems.net, 2017.
2.	M. Singhal, N. G. Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw-Hill, 2012.
3.	S.K. Basu, Parallel and Distributed Computing: Architectures and Algorithms, PHI, 2016.
4	G. Ananth, A. Gupta, G. Karypis, V. Kumar, Introduction to Parallel Computing, Second Edition, Addision Wesley, 2003.
Reference Books	
1.	Ajay Kshemkalyani and Mukesh Singhal. Distributed computing: principles, algorithms, and systems. Cambridge University Press, 2011.
2	Sukumar Ghosh,. Distributed systems: an algorithmic approach. Chapman and Hall/CRC, 2014.
3.	A. Kulkarni, N.P. Giri, N. Joshi, Bhushan Jadhav, Parallel and Distributed Systems, Wiley Publications, 2016.
4.	K. Hwang, Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing- From Parallel Processing to the Internet of Things", Morgan Kauffman Publishers, Elsevier. 2014.
5.	IEEE, ACM Transactions, Journals and Conference papers on "Distributed and Cloud Computing."
6.	R. K. Buyya, J Broberg, Adnrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley Publisher. 2014

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K302.1	2	1	1			1	1	1	2	1
K302.2	2	2	1	1	1	2	2	1	2	2
K302.3	2	2	2	2	2	2	2	2	2	2
K302.4	2	2	2	2	2	2	2	2	2	2

Avg	**2 .00**	**1.75**	**1.50**	**1.67**	**1.67**	**1.75**	**1.75**	**1.50**	**2.00**	**1.75**

Computer Networks (24B51CS354)

Course Description

Subject Code	**24B51CS354**	**Semester Odd**	**Semester V Session 2024-25 Month from Jul to Dec 2024**
Subject Name	**Computer Networks**		
Credits	**4**	**Contact Hours**	**3-1-0**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K303.1	illustrate the basics of networking, different network models and underlying technologies of physical layer.	Understanding (C2)
K303.2	experiment with various application layer protocols and switching techniques.	Applying (C3)
K303.3	apply Data Link Layer protocols for communication and error detection and correction.	Applying (C3)
K303.4	inspect various transport layer services and its associated protocols.	Analyzing (C4)
K303.5	evaluate different addressing mechanisms and routing protocols at network layer.	Evaluating (C5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures**
1.	**Introduction to Networking**	Introduction: Data communications, networks, network types, Internet history, standards and administration, Network Topologies. Network Models: Protocol layering, TCP/IP protocol suite, The OSI model. Switching: Introduction, circuit switched networks, packet switching.	7
2.	**Application Layer**	Principles of Application-Layer Protocols, World-wide-web and HTTP, FTP, Electronic mail, Domain name system.	6
3.	**Transport Layer**	Introduction to the Transport Layer: Introduction, Transport layer services, Transport layer protocols (Simple protocol, Stop-and-wait protocol, Go-Back-n protocol, Selective repeat protocol),	8

		UDP/TCP: User datagram protocol, Transmission control protocol, Connection Establishment. Flow Control and Error Control, Congestion Control	
4.	**Network Layer**	Introduction to the Network Layer: Network layer services, network layer performance, IPv4 addressing (Classful & Classless), Subnetting, Supernetting forwarding of IP packets, Fragmentation. Unicast Routing: Introduction, routing algorithms, unicast routing protocols (Link State & DSDV).	9
5.	**Data Link Layer**	Introduction to the Data Link Layer: Link layer addressing, Data Link Layer Design Issues, Error detection and correction, block coding, cyclic codes, checksum, forward error correction, error correcting codes, error detecting codes, Hamming Codes Media Access Control: Random access, controlled access.	8
6.	**Physical Layer**	Introduction to Physical layer: Data and signals, periodic analog signals, digital signals, transmission impairment, data rate limits, performance Bandwidth Utilization: Multiplexing and Spectrum Spreading: Multiplexing, Spread Spectrum Transmission media: Guided Media, Unguided Media	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Term	35
TA	25 (PBL, Assignments, Attendance, Quiz, etc.)
Total	**100**

Project Based Learning: Each student in a group of 2-4 will choose some real-world problems of networking such as congestion control, network traffic analyser etc. By applying the different network protocol layer concepts and with the help of simulators it helps the students in enhancing their understanding and skills.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	James Kurose, Keith Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Addison Wesley, 8th edition, 2022
2	Forouzan, B. A., "TCP/IP protocol suite". McGraw-Hill Higher Education, 4th edition, 2017

References Books	
1.	Forouzan, A. B., "Data communications & networking", Tata McGraw-Hill Education, 5th edition, 2017
2.	Andrew S. Tanenbaum, "Computer Networks", Prentice-Hall Publishers, 6th edition, 2022
3.	Larry Peterson, Bruce Davie, "Computer Networks a Systems Approach", Morgan Kaufmann, 6th edition, 2021
4.	William Stallings, "Data and Computer Communications", Prentice Hall, 8th edition, 2009

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K303.1	2	1							1	
K303.2	2	1	2	1	1		1	1	2	1
K303.3	2	1	1						1	
K303.4	2	2	2	1	1		1	1	2	1
K303.5	2	2	2	1	1		1	1	2	1
Avg	**2.00**	**1.40**	**1.75**	**1.00**	**1.00**		**1.00**	**1.00**	**1.60**	**1.00**

Computer Networks Lab (24B55CS355)

Course Description

Subject Code	**24B55CS355**	**Semester Odd**	**Semester V Session 2024-25 Month from Jul to Dec 2024**
Subject Name	**Computer Networks Lab**		
Credits	**1**	**Contact Hours**	**0-0-2**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K332.1	classify all the wired/wireless technologies and the basic network building blocks.	Understanding (C2)
K332.2	visualize and analyze the data packets of different TCP/IP layers.	Applying (C3)
K332.3	model a communication network and Estimate its performance.	Applying (C3)

K332.4	create client and server applications using the "Sockets" and the implementation of various protocols at Data link and TCP layer.	Analyzing (C4)
K332.5	design and develop various solution to real-world problems	Creating (C6)

Module No.	Subtitle of the Module	Topics in the module	Number of Labs
1.	**Introduction**	Introduction to Computer Network devices / UNIX Commands for TCP/IP Protocol	2
2.	**Wireshark Simulator**	Practice on WIRESHARK with tcpdump : Application Layer (HTTP,DNS) , Transport Layer (TCP, UDP).	4
3.	**Socket Programming**	Client server programming using TCP and UDP	2
4.	**Network Simulator (NS2)**	Introduction, Topology creation, Visualization, Performance evaluation of TCP &UDP with CBR & FTP traffics, Tracking (AWK Scripting), Plotting through X graph, event driven simulation in NS2	3
5.	**Multicasting/ Broadcasting**	Introduction, Multicast vs Broadcast Routing using ns-2, Estimate the delay caused in the network due to congestions and link breakages	1
6.	**Modeling a realistic Network**	Simulate and compare different error detection and correction and buffer management techniques.	2
		Total No. of Labs	14

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	20
End Term	20
Day to day work	60
Total	**100**

Project based learning: In groups of 2-3, students will choose a networking application or technology to analyze. They will study the OSI model's layers, examining how data flows through each layer and the relevant protocols. The project will also address sustainability challenges like energy efficiency and waste management, highlighting their impact on network design. This hands-on approach helps students understand modern networking applications and issues, enhancing their practical knowledge and employability into related sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet " 6th Edition Pearson Education, 2017.
2.	Andrew S. Tanenbaum," Computer Networks" 4th Edition, 2002
Reference Books	
3.	UNIX Network Programming, Volume 1, Second Edition: Networking APIs: Sockets and XTI, Prentice Hall, 1998, ISBN 0-13-490012-X.
4.	TeerawatIssariyakul, Ekram Hossain, "Introduction to Network Simulator NS2", Springer. 2009
5.	Anish nath, "Packet Analysis with Wireshark Paperback," Packt Publishing, 2015.
6.	Yoram Orzach, "Network Analysis Using Wireshark Cookbook," Packt Publishing, 2013.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K332.1	3	2	1		1	2		1	3	1
K332.2	2	1	2	2	1			1	2	2
K332.3	2	1	2	2	1			1	2	2
K332.4	2	2	3	2	1	3		1	2	2
K332.5	3	3	3	3	2	2		2	3	3
Avg	**2.40**	**1.80**	**2.20**	**2.25**	**1.20**	**2.33**		**1.20**	**2.40**	**2.00**

Number Theory and Cryptography (24B21MA311)

Course Description

Course Code	**24B21MA311**	**Semester Odd**	**Semester V Session 2024-25 Month from Jul to Dec 2024**
Course Name	**Number Theory and Cryptography**		
Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K321.1	define basic concepts related to number theory.	Remembering (C1)
K321.2	explain theory of congruences, Galois field and cryptography.	Understanding (C2)

K321.3	apply theory of congruences and Galois field for solving system of congruences and constructing cryptography algorithms.	Applying (C3))
K321.4	examine security and applications of cryptography algorithms.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	**Divisibility and Primes**	Division algorithm, Greatest common divisor, Euclid's algorithm, gcd as a linear combination of integers, primes, The fundamental theorem of arithmetic, Least common multiple, Prime number theorem (statement only), Testing for Primality.	4
2	**Theory of Congruences**	Definitions and basic properties, Linear Diophantine equations, Residue classes, complete residue systems, reduced residue systems, multiplicative inverse, Linear congruences in one variable, Simultaneous linear congruences, Chinese remainder theorem and its applications, Linear congruences in more than one variable	6
3.	**Primitive Roots and Indices**	Fermat's theorem, Multiplicative function, The Euler's totient function, Euler's theorem, The order of an integer, Primitive roots, Theory of indicies, Solution of non-linear congruences.	7
4.	**Galois field**	Finite fields of the form $GF(p)$, Polynomial arithmetic with coefficients in Z_p, irreducible polynomial, modular polynomial arithmetic, finite fields of the form $GF(2^n)$, irreducible polynomial on $GF(2^8)$, isomorphism among $GF(2^n)$ and $\{0,1\}^n$.	7
5.	**Theory of Cryptography**	Encryption/Decryption, Authentication, Integrity, Digital Signature, key exchange, key management, symmetric cryptography, public key cryptography, AES, DES.	5
6.	**Cryptography Algorithms**	Hill Cipher, RSA cryptosystem, Elgmal Cryptosystem, AES, Cryptanalysis of cryptography algorithms.	7
7.	**Applications of Cryptography**	Diffie-Hellman key exchange, Key Management, Digital Signature Standard.	6
		Total number of Lectures	**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials)
Total	**100**

Project based learning: A group of 4 to 5 students will be formed. Each group will be assigned a problem related to the security and applications of cryptography algorithms. Every group will submit a common report.	
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	**David M. Burton**, Elementary Number Theory, 7th Edition, McGraw Hill Education (India) Private Limited, 2017.
2.	**Kenneth Rosen**, Elementary Number Theory and its Applications, 6th Edition, McGraw Hill, 2010.
3.	**William Stallings**, Cryptography and Network Security, Principles and Practices, 8th Edition, Pearson Education Limited, 2023.
4.	**Dirk Hachenberger, Dieter Jungnickel**, Topics in Galois Fields, Springer, 2020.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K321.1	2	2	2	1	1		1	1	2	1
K321.2	2	2	2	1	1		1	1	2	2
K321.3	1	2	2	1	1		1	1	2	1
K321.4	3	2	2	1	1		1	1	2	2
Avg	**2.00**	**2.00**	**2.00**	**1.00**	**1.00**		**1.00**	**1.00**	**2.00**	**1.50**

Summer Internship (24B27MA311)

Course Description

Course Code	**24B27MA311**	**Semester: Odd**	**Semester V Session 2024-25 Month from Jul 2024 to Dec 2024**	
Course Name	**Summer Internship**			
Credits	**4**	**Contact Hours**	**0-0-8**	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			
COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:				**COGNITIVE LEVELS**
K381.1	relate the knowledge gained from the industrial experience with the subject areas.			Understanding (C2)
K381.2	demonstrate a capacity for critical reasoning and independent learning.			Understanding (C2)
K381.3	utilize the experience gained to enhance their knowledge and skill capabilities for report writing.			Applying (C3)
K381.4	analyse and align their academic and career goals.			Analyzing (C4)

Evaluation Criteria	
Components	**Maximum Marks**
Diary	20
Viva	50
Report	30
Total	**100**

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K381.1	3	2	2	3	1		3	1	2	3
K381.2	3	2	2	3	1		3	1	2	3
K381.3	3	2	3	3	2		3	2	2	3
K381.4	3	2	2	3	1		3	2	2	3
Avg	**3.00**	**2.00**	**2.25**	**3.00**	**1.25**		**3.00**	**1.50**	**2.00**	**3.00**

Sixth Semester

Cloud Computing (25B51CS361)

Course Description

Course Code	**25B51CS361**	**Semester: Even**	**Semester** VI **Session** 2024-25 **Month from** Jan-May 2025
Course Name	**Cloud Computing**		
Credits	**3**	**Contact Hours**	3-0-0
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K311.1	Explain Cloud Foundational Elements, Deployment & Service Models, Architectures, Virtualization, Protocols, Web services, Security and IOT principles.	Understanding (C2)
K311.2	Apply Cloud principles on various Cloud Technologies, Service Models, Virtualization, Protocols etc.	Applying (C3)
K311.3	Develop Various Cloud based Protocols, Web Services, and Applications.	Applying (C3)
K311.4	Analyze Cloud based Case studies along with Elements of Security and IOT.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Overview of Distributed Computing	Trends in Computing, Distributed Computing, System models for Distributed, Client Server Models, Peer to Peer Models.	3

2.	Introduction to Cloud Computing, Issues and Challenges	Introduction to Cloud Computing, Pay-as-per-use Model, Enabling Technologies, History of Cloud Computing, Deployment Models, Private, Public, Community, Hybrid, Service models, IaaS, PaaS, SaaS. Essential Characteristics, Foundational Elements and Enablers of Cloud Model.	5
3.	Cloud Architecture	Traditional Computing Architecture, Layers of Traditional Architecture, their Pros and Cons. Cloud Computing Architecture, Various Models.	4
4.	Virtualization Techniques	Role of Virtualization in Cloud Computing, Virtualization of resources and related issues. Virtualization Techniques, ISA Level virtualization, Hardware Abstraction level, OS level, Library Level, Application-Level virtualization techniques. Types of hardware virtualization: Full virtualization - partial virtualization - para virtualization, Desktop virtualization: Software virtualization – Memory virtualization - Storage virtualization – Data virtualization – Network virtualization, Introduction to Intel Virtualization Technology (IVT), IA 32 and IA 64 architectures, Challenges in the design of these architectures.	8
5.	Cloud Services and platforms	Current Cloud Services such as Amazon Web Services, Elastic Cloud Compute (EC2), Storage Services, Database Services.	8
6.	Cloud Application Developments	Design considerations for Cloud Applications, Cloud Application Design Methodologies, Service Oriented Architectures, Cloud based Web Services, Containers.	8
7.	Cloud Security	Current state of data in cloud and data security in cloud, Network level security, Access management and control, Authentication in cloud computing.	3
8.	Cloud computing in IoT	Introduction to Cloud Computing in IoT. Applications of Cloud in IoT for Sustainable developments.	3
		Total Number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: A group of a maximum of 2-4 students may be formed. Each group shall choose a Cloud based project. The project shall be based on Emerging Technologies in Cloud Computing, architectures, tools, simulation tools, Cloud Platforms like AWS, Google Cloud. Each group has to do literature survey and submit a report/research paper on the project. The project evaluation shall be done based on the quality, relevance, innovation and creativity involved.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books	
1.	Arshadeep Bagha, Vijay Madisetti, "Cloud Computing: A Hands-on Approach", University Press, 2014.
2.	Sosinsky Barrie, "Cloud Computing Bible", John Wiley & Sons, 2011.
3.	Anthony Velte, Toby Velte, Robert C. Elsenpeter, "Cloud Computing, A Practical Approach", McGrawhill, 2010.
4.	R. K. Buyya, J Broberg, Adnrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley Publisher, 2011.
Reference Books	
1.	Shailendra Singh, "Cloud Computing" Oxford University Press, 2018.
2.	IEEE, ACM Transactions, Journals and Conference papers on "Distributed and Cloud Computing."
3.	Dan C. Marinescu, "Cloud Computing: Theory and Practice", Morgan Kauffman Publishers, Elsevier.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K311.1	3			3	2	2			2	2
K311.2	3	2	3	3			3	3	3	3
K311.3	3	2	3	3			3	3	3	3
K311.4	3	3	3	3	2	2	3	3	3	3
Avg	**3.00**	**2.33**	**3.00**	**3.00**	**2.00**	**2.00**	**3.00**	**3.00**	**2.75**	**2.75**

Cloud Computing Lab (25B55CS362)

Course Description

Course Code	**25B55CS362**	**Semester: Even**	**Semester** VI **Session** 2024-25 **Month from** Jan-May 2025
Course Name	**Cloud Computing Lab**		
Credits	**1**	**Contact Hours**	0-0-2
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:			**COGNITIVE LEVELS**
K336.1	Explain Cloud Service Models, Deployment models, etc.		Understanding (C2)
K336.2	Develop API and Web Services		Applying (C3)
K336.3	Construct Cloud based applications on available Cloud Platforms.		Applying (C3)
K336.4	Apply and Analyze Cloud based applications by using different services offered by recent Cloud Platforms.		Analyzing (C4)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Understand Cloud Architectures,	Different Cloud Services offered by various Service Providers	**2**

	Models, Service Models		
2.	Development of Web Service Applications	Demonstration of Web services and API with simple web service implementations. Development of Web service applications by using various web-based tools, like REST, JSON, etc.	6
3.	Development of Cloud and Web Services based application on Cloud Platforms	Develop Cloud based applications and on Cloud Platforms Like Amazon Web Services (AWS)	6
Total Number of Labs			**14**

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60 (D2D: 40 marks, PBL: 20 marks)
Total	**100**

Project based learning Project Based Learning: A group of maximum 2-4 students are formed. Each group chooses a Cloud and Web Services based project. The project shall be designed and/or modeled based on any Cloud and Web Services based Platform like AWS, RESTful Services, WSDL or any Cloud or Web Services based tools. The project shall function and run as per its objective. Live demonstration of the project shall be shown. The project evaluation shall be done based on the quality, innovation, relevance and creativity involved.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	Anthony Velte, Toby Velte, Robert C. Elsenpeter, "Cloud Computing, A Practical Approach", McGrawhill, 2010.
2.	David Clinton, "Learn Amazon Web Services in a Month of Lunches", Manning, 2017.
3.	George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly publication, January 2011.
4.	Arshdeep Bahga, Vijay Madisetti, "Cloud Computing: A Hands-on Approach", Universities Press, 2014.

Reference Books/Resources:

1.	Wilkins, Mark, "Learning Amazon Web Services (AWS): a Hands-on Guide to the Fundamentals of AWS cloud", Addison-Wesley Professional, 2019.
2.	B. Jin, S. Sahni, and A. Shevat, "Designing Web APIs: Building APIs that developers love". O'Reilly Media, 2018.
3.	M. Grinberg," Flask Web Development: Developing Web Applications with Python", O'Reilly Media, 2018.
4.	Christopher M. Moyer, "Building Applications in the Cloud: Concepts, Patterns and Projects", Pearson Education India, 2011.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K336.1	3			3	2	2			2	2
K336.2	3	2	3	3			3	3	3	3
K336.3	3	2	3	3			3	3	3	3
K336.4	3	3	3	3	2	2	3	3	3	3
Avg	**3.00**	**2.33**	**3.00**	**3.00**	**2.00**	**2.00**	**3.00**	**3.00**	**2.75**	**2.75**

Fundamentals of Soft Computing (24B21MA313)

Course Description

Course Code	**24B21MA313**	**Semester: Even**	**Semester VI** **Session** 2024-25 **Month from** Jan-May2025
Course Name	**Fundamentals of Soft Computing**		
Credits	**4**	**Contact Hours**	3-1-0
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K312.1	explain the basic concepts of soft computing, fuzzy logic, optimization problems and artificial neural networks.	Understanding (C2)
K312.2	solve fuzzy systems and single objective optimization problems.	Applying (C3)
K312.3	make use of evolutionary algorithms to solve multi-objective optimization problems.	Applying (C3)
K312.4	analyze soft computing techniques to solve related problems.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Introduction of Soft Computing	Overview of Soft Computing, Difference between Soft and Hard computing. Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.	3
2.	Fuzzy Logic	Introduction to fuzzy logic, membership functions, Operations on Fuzzy Sets, Fuzzy relations and rules, Implications	6

3.	Fuzzy Systems	Fuzzy Inference, Defuzzification techniques, Fuzzy logic controllers, Applications of fuzzy logic.	6
4.	Optimization Problems	Optimization Problems, Metaheuristic techniques, Concept of Genetic Algorithm, GA Strategies	5
5.	Genetic Algorithm	GA operators: Encoding, Selection, Crossover, Mutation, Single Objective optimization problems using GA.	8
6.	Multi-Objective Optimization Problem	Concept of MOOPs, Multi-Objective Evolutionary Algorithms, Pareto based approaches, Some applications with MOEAs.	8
7.	Artificial Neural Networks	Biological Neurons and its working, Introduction to ANN, ANN architecture, ANN training.	6
		Total Number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: Each student in a group of 3-4 will collect literature on soft computing techniques. To make the subject application based, the students analyze the soft computing techniques to solve real life problems.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	**T.J. Ross,** Fuzzy Logic with Engineering Applications, John Wiley & Sons, 2010.
2.	**D. E. Goldberg,** Genetic Algorithms in Search, Optimization and Machine Learning, Pearson Education, 2002.
3.	**R.L. Haupt, S.E. Haupt,** Practical Genetic Algorithms, John Willey & Sons, 2002.
4.	**S. Rajasekaran, G. A. Vijayalakshmi Pai**, Neural Networks, Fuzzy Logis and Genetic Algorithms: Synthesis, and Applications, Prentice Hall of India, 2007.
5.	**S. Haykin**, Neural Networks and Learning Machines, (3rd Edn.), PHI Learning, 2011.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO

K312.1	1	2	1		1				1	1
K312.2	2	3	2		2				2	2
K312.3	2	3	2		2				2	2
K312.4	3	3	3	1	3	1	2	1	2	3
Avg	**2.00**	**2.75**	**2.00**	**1.00**	**2.00**	**1.00**	**2.00**	**1.00**	**1.75**	**2.00**

Java Programming (25B51CS363)

Course Description

Course Code	**25B51CS363**	**Semester: Even**	**Semester** VI **Session** 2024-25 **Month from** Jan-May 2025
Course Name	**Java Programming**		
Credits	**3**	**Contact Hours**	3-0-0
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K313.1	explain basic concepts of Object-Oriented Programming.	Understanding (C2)
K313.2	develop basic Java programs using Java constructs – loops, switch-case and arrays.	Applying (C3)
K313.3	develop GUI based application programs.	Applying (C3)
K313.4	examine java programs using exception handling, multi-threading and Java collection framework.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Introduction to Java	Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods)	6
2.	Arrays, Strings and I/O	Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String	5

		Objects, Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System.out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.	
3.	Object-Oriented Programming Overview	Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection.	5
4.	Inheritance, Interfaces, Packages, Enumerations, Autoboxing and Metadata	Inheritance: (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, Extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Autoboxing/Unboxing, Enumerations and Metadata.	8
5.	Exception Handling, Threading, Networking and Database Connectivity	Exception types, uncaught exceptions, throw, built-in exceptions, Creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulating databases using JDBC.	10
6.	Applets and Event Handling	Java Applets: Introduction to Applets. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using the AWT controls.	**8**
		Total Number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning The students will work in a group of 3/4 members. In the mini-project, students will be able to develop applications using OOPS concepts. Further they will be able to explore various collections and APIs. The course emphasized on the Skill development of students in Java Programming. Topics like inheritance, classes, exception handling, multithreading, collection frameworks, GUI, etc. are taught to enhance the programming skills of the students for making them ready for employability in software development companies.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
Text Books	
1.	Cay S. Horstmann, GaryCornell, "Core Java 2 Volume 1, 10th Edition,Printice Hall.2016
2.	James Gosling, Bill Joy, Guy L Steele Jr, GiladBracha, Alex Buckley"The Java Language Specification, Java SE 8 Edition (Java Series)", Published by Addison Wesley, 2014.
3.	Cay S. Horstmann, Gary Cornell, "Core Java 2 Volume 2 - Advanced Features)", 9th Edition, Printice Hall. 2013
4.	Paul Deitel, Harvey Deitel, "Java: How to Program", 10th Edition, Prentice Hall, 2011.
Reference Books	
1.	Schildt, H. (2021). Java: The Complete Reference, Twelfth Edition. United States: McGraw Hill LLC.
2.	E. Balaguruswamy, "Programming with Java", 7th Edition, McGraw Hill.2023.
3.	Joshua Bloch, "Effective Java" 3rd Edition, Publisher: Addison-Wesley, 2016.
4.	John R. Hubbard, "Programming with JAVA", Schaum's Series, 2nd Edition, 2004.
5.	Kathy Sierra, Bert Bates, "Head First Java", Orielly Media Inc. 3rd Edition, 2022.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K313.1	2	2	2	1	1	1	2	1	1	2
K313.2	1	2	2	1	1	1	1	1	1	2
K313.3	2	2	2	1	1	1	2	1	1	2
K313.4	3	2	3	1	1	1	3	2	2	3
Avg	**2.00**	**2.00**	**2.00**	**1.00**	**1.00**	**1.00**	**2.00**	**1.00**	**1.00**	**2.00**

Java Programming-Lab (25B55CS364)

Course Description

Course Code	**25B55CS364**	**Semester: Even**	**Semester** VI **Session** 2024-25 **Month from** Jan-May 2025
Course Name	**Java Programming-Lab**		
Credits	**1**	**Contact Hours**	0-0-2
	Coordinator(s)		
	Teacher(s) (Alphabetically)		
COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:			**COGNITIVE LEVELS**
K337.1	explain basics of Java programming.		Understanding (C2)

K337.2	apply concepts of object oriented programming in Java.	Applying (C3)
K337.3	develop GUI based application programs.	Applying (C3)
K337.4	examine Java programs using Exception Handling, Multithreading and Java collection framework.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Introduction to basic Java Programming	Data types, variable, arrays, expressions, operators, and Control flow (conditional statements, loop, etc), Objects and classes.	3
2.	Application of OOPs Concept	Inheritance, use of keywords such as Final, Static, etc. with variable, methods and classes. Abstract classes, Static classes, Inner classes, Packages, Wrapper classes, Interfaces, This, Super, Access control, Abstract class, class constructors and method overloading	4
3.	Exception Handling and Multithreading	Exception handling (try, catch, throw, throws, and finally), Simple thread program, Thread synchronization	3
4.	Java Collection Framework	Collection Overview, List, Map (hash Code& Equals), Set, Queue & other collections, Stream API to process collections of objects	2
5.	Applets and Event Handling	Java Applets: Introduction to Applets. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using the AWT controls.	2
Total Number of Labs			**14**

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60 (Quiz, Assignments, PBL)
Total	**100**

Project based learning: The students will work in a group of 3/4 members. In the mini-project, students will be able to develop applications using OOPS concepts. Further they will be able to explore various collections and APIs. The course emphasized on the Skill development of students in Java Programming. Topics like inheritance, classes, exception handling, multithreading, collection frameworks, GUI, etc. are taught to enhance the programming skills of the students for making them ready for employability in software development companies.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	Schildt, H. (2021). Java: The Complete Reference, Twelfth Edition. United States: McGraw Hill LLC.
2.	E. Balaguruswamy, "Programming with Java", 7th Edition, McGraw Hill.2023.
3.	Horstmann, C. S. (2021). Core Java: Fundamentals, Volume 1. United Kingdom: Pearson.
4.	Curry, C. (2020). Object-Oriented Programming with Java. United States: Addison-Wesley Professional.
5.	Loy, M., Niemeyer, P., Leuck, D. (2020). Learning Java: An Introduction to Real-World Programming with Java. United States: O'Reilly Media.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K337.1	3	2	2	1			1	1	2	3
K337.2	3	2	3	2			2	1	2	3
K337.3	3	3	3	2			2	1	2	3
K337.4	3	2	3	3			3	2	3	3
Avg	3.00	2.00	3.00	2.00			2.00	1.00	2.00	3.00

Software Engineering (25B51CS365)

Course Description

Course Code	**25B51CS365**	**Semester: Even**	**Semester VI Session 2024-25** **Month from** Jan-May 2025
Course Name	**Software Engineering**		
Credits	**3**	**Contact Hours**	3-0-0
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K314.1	explain software engineering principles and software process models for project development and develop software requirement specification.	Understanding (C2)
K314.2	apply UML modeling for software design from software requirements specification.	Applying (C3)
K314.3	apply testing principles, develop and implement various manual and automated testing procedures, formal methods.	Applying (C3)
K314.4	examine software in terms of general software quality attributes and possible trade-offs presented within the given problem.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	**Introduction to Software Engineering**	Introduction to software engineering Principles, Software process models (build and fix model, waterfall model, Incremental process model, Evolutionary-Prototype and Spiral models, Agile Models (tools study). Project planning, COCOMO Model, Project Scheduling: network diagram, Gant Chart, CPM and PERT.	7
2.	**Requirement Engineering**	Types of requirement, Requirement Elicitation, Analysis, Specification, SRS, Requirement Verification and Validation.	4

3.	**Software Design**	Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Component Diagram and Package diagram. Design Modularity: Coupling Cohesion.	7
4.	**Software Construction**	Coding standards and guidelines, Code checklist, Code Reviews, Code Refactoring, Code optimization. Design pattern, Modern programming environments (Code search, Programming using library components and their APIs), Program comprehension; Program correctness, Defensive programming.	8
5.	**Software Metrics**	Size-Oriented Metric, Function-oriented Metric, Halstead's Software Metric, Information Flow Metric, Object-oriented Metric, Class-Oriented Metric.	7
6.	**Software Testing**	White-Box Testing, Basis Path Testing, Control Structure Testing: Condition Testing, Data Flow Testing, Loop Testing, Black-Box Testing: Equivalence class partitioning, Boundary Value Analysis, Decision table testing, Cause effect graphing, Mutation Testing and regression Testing, formal methods.	9
Total Number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: Each student works on different case study in Tutorial and Assignments. They utilize the concepts taught in lecture and develop project in a group of 3-4. The course emphasized on the skill development for employability in software industry by engaging students on Software Development methodologies. Various activities are carried out to enhance the student's software development skills. Some of them are study of various software process models and their applicability, progress tracking, size estimation techniques, software testing strategies, etc.

Recommended Reading material:

1.	Roger S. Pressman, "Software Engineering: A practitioner approach", Seventh Edition, TMH, 2010.
2.	Ian Sommerville, "Software Engineering", Ninth Edition, Addison-Wesley, 2011.
3.	Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Addison Wesley, Reading, Massachusetts, 2005
4.	Richard Thayer, "Software Engineering Project Management", Second Edition -Wiley-IEEE Computer Society Press, 1997.
5.	B. Bezier, "Software Testing Techniques", Second Edition- International Thomson Computer Press, 2003.
6.	Pankaj Jalote, "An Integrated Approach to Software Engineering" Third edition, Springer Press, 2005.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K314.1	3	2	1	1	1			3	1	2
K314.2		3	3	2			3		1	3
K314.3		2	3	2	1				1	3
K314.4	1	1		1					1	3
Avg	**2.00**	**2.00**	**2.25**	**1.50**	**1.00**		**3.00**	**3.00**	**1.00**	**2.75**

Software Engineering Lab (25B55CS366)

Course Description

Course Code	**25B55CS366**	**Semester: Even**	**Semester VI Session 2024-25** **Month from** Jan-May 2025
Course Name	**Software Engineering Lab**		
Credits	**1**	**Contact Hours**	0-0-2
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K338.1	identify the software requirements and prepare SRS documents.	Understanding (C2)
K338.2	design the software model for the given project.	Applying (C3)
K338.3	test the quality of the project using the testing principles.	Analyzing (C4)
K338.4	evaluate the software metrics for the developed project.	Evaluating(C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	**Problem Analysis and Project Planning**	Identify a real world problem, Determine its project scope, Objectives and Infrastructure.	1
2.	**Software Requirement Analysis**	Describe the individual Phases/modules of the project and Identify deliverables. Preform feasibility study. Identify functional and non-functional requirements. Prepare SRS of the project planned.	2
3.	**Software design modelling**	Develop use case diagrams activity diagrams, class diagrams, sequence diagrams and add interface to class diagrams.	4
4.	**Develop prototype**	Develop of protype of project proposed	2
5.	**Testing**	Test the prototype for black box white box testing	3
6.	**Evaluate the software**	Assess the software on different software metrics	2
Total Number of Labs			**14**
Evaluation Criteria			

Components	Maximum Marks
Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60 (Quiz, Assignments, PBL)
Total	**100**

Project based learning: Each student works on different case study in Tutorial and Assignments. They utilize the concepts taught in lecture and develop project in a group of 3-4. The course emphasized on the skill development for employability in software industry by engaging students on Software Development methodologies. Various activities are carried out to enhance the student's software development skills. Some of them are study of various software process models and their applicability, progress tracking, size estimation techniques, software testing strategies, etc.

Recommended Reading material:

1.	Roger S. Pressman, "Software Engineering: A practitioner approach", Seventh Edition, TMH, 2010.
2.	KK Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers, Second Edition, 2005.
3.	Pankaj Jalote, "An Integrated Approach to Software Engineering" Third edition, Springer Press, 2005.
4.	David Solomon and Mark Russinovich," Inside Microsoft Windows 2000", Third Edition, Micorosoft Press, 2000.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K338.1	1	3		2	1		2	3	1	2
K338.2	2	2	3	3			2		1	1
K338.3	2	1	2	3			2		1	1
K338.4	2						2		2	3
Avg	**1.75**	**2.00**	**2.50**	**2.67**	**1.00**		**2.00**	**3.00**	**1.25**	**1.75**

Operations Research (24B21MA312)

Course Descriptions

Course Code	**24B21MA312**	**Semester: Even**	**Semester** VI **Session** 2024 -2025 **Month from** Jan -May 2025
Course Name	**Operations Research**		
Credits	**4**	**Contact Hours**	**3-1-0**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K326.1	explain fundamentals of linear programming problem and primal-dual relationship.	Understanding (C2)
K326.2	apply different methods to solve linear programming problems.	Applying (C3)
K326.3	solve transportation and assignment models.	Applying (C3)

K326.4	analyze the problems related to game theory.		Analyzing (C4)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Linear Programming Problems (LPP)-I	Introduction, Applications in various fields of Operations Research, Formulation of LPP., Convex Sets, Graphical Method, Fundamental Theorem of LPP.	6
2.	Linear Programming Problems (LPP)-II	Basic Solutions, Simplex Method, Big-M Method, Two Phase Method, Special Cases in Simplex Method.	8
3.	Duality	Primal-Dual Relationship, Duality, Weak and strong duality theorems, Dual Simplex Method.	6
4.	Transportation Problems	Introduction, Matrix Form, Applications, Basic Feasible Solution- North West Corner Rule, Least Cost Method, Vogel's Approximation Method. Degeneracy, Resolution on Degeneracy, Optimal Solution, Maximization TP Model.	8
5.	Assignment Problems	Definition, Hungarian Method, Traveling Salesmen Problems, Unbalanced Assignment Problems.	6
6.	Game Theory	Rectangular Games, Minmax Theorem, Graphical Solution of 2×n, 3×n, m×2, m×3 and m×n Games, Solution of games using LPP.	8
		Total Number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project Based Learning: Each student in a group of 4-5 will collect literature on transportation and assignment problem to solve some practical problems. To make the subject application based, the students analyze the optimized way to deal with afore mentioned topics.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Taha, H. A. - Operations Research - An Introduction, Pearson Education, 2011.
2.	Hadley, G. - Linear Programming, Massachusetts: Addison-Wesley, 1962.
3.	Hiller, F.S. and Lieberman, G. J. - Introduction to Operations Research, San Francisco, 1995.
4.	Wagner, H. M. - Principles of Operations Research with Applications to Managerial Decision, PHI, 1975.
5.	Vohra, N. D., Quantitative Techniques in Management, Second Edition, TMH, 2003.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K326.1	2	2	1				1		1	1
K326.2	2	3	2				2		1	2
K326.3	2	3	2				2	1	1	2

K326.4	3	3	2				2		1	1
Avg.	**2.25**	**2.75**	**1.75**				**1.75**	**1.00**	**1.00**	**1.50**